THE

ONTARIO WATER RESOURCES COMMISSION

COMPREHENSIVE WATER RESOURCES STUDY of the CITY OF BARRIE

1971

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OF THE

CITY OF BARRIE

MAY TO AUGUST, 1971

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I INTRODUCTION

The following is a routine comprehensive report on the status of municipal water pollution control within the City of Barrie. A discussion is made of the hydraulic and organic performance of the municipal water pollution control plant, and an evaluation of the municipal water works system. An assessment of the general quality of the water of Kempenfelt Bay and local inland watercourses is made in a 1971 follow-up study of the 1966 OWRC water pollution survey along with the conclusions of past surveys. The City's development and future plans in pollution abatement are also discussed.

II GENERAL

The City of Barrie, the County Seat of Simcoe County, is located at the west end of Kempenfelt Bay, Lake Simcoe, at the junction of Highways 11, 27 and 90, approximately 55 miles north of Metro Toronto. In 1970 the total population was 26,273, the total land acreage 6,760 acres, and the total water acreage 852 acres.

According to the 1970 edition of the Industrial Surveys by the Department of Trade and Development, the City has had a population increase of 11.6 per cent in the last 5

years as compared to the County's 10.8 per cent. Approximately 22 per cent of the City's population is involved in manufacturing, retail, Federal or Provincial Government facilities, and commuting to other centres.

Drainage from the city reaches Kempenfelt Bay directly by storm sewers or by tributaries flowing to that body of water. There are five streams, designated in this report as Streams A, B, C, D and E, which rise in the northern section of the city and meander generally southward to their discharge points at Kempenfelt Bay. Certain sections of these streams have been enclosed to act as municipal sewers.

Approximately 100 per cent of the city is served by municipal water distribution and sewer collector systems.

III MUNICIPAL WATER WORKS

A. Description of Works

Water for the city is presently supplied by six drilled wells ranging in depth from 70 to 348 feet.

In all but the John Street and Wood Street wells, water is pumped into underground reservoirs before being pumped into the distribution system. Chlorination and sodium silicate (@ 28.7%) treatment are provided at all the wells.

The four underground reservoirs, a reinforced concrete reservoir on the low level distribution system, and

a standpipe located at one of the booster stations provide a total storage capacity of 2,693,500 gallons.

The combined well pump capacity is 9.2 MGD.

A full physical description is appended in Appendix A.

B. Water Consumption

Appendix C, Tables 1 and 2 present a summary of the total water consumption during the years of 1969 and 1970. A 1970 total of 1,053,626,300 IG or an average of 2,886,647 IGPD, represents a decrease over the 1969 consumption by roughly 5 per cent.

The following summary lists all of the 1970 consumption information.

1970 CONSUMPTION INFORMATION

Population Served	-	26,650
Total Water Produced	-	1,053,626,300 gallons
Residential Consumption	-	431,067,500 or 41%
Commercial & Industrial Consumption	-	579,305,000 or 55%
Unaccounted Losses	-	43,253,800 or 4%
Per Capita Consumption (Combined)	-	108.3 gals./cap./day
Per Capita Consumption (Residential)	-	44.3 gals./cap./day
Per Capita Consumption (Comm. & Ind.)	-	59.6 gals./cap./day
Per Capita Consumption (Unacc. Losses)	-	0.06 gals./cap./day

Avg. Daily Consumption (Combined)	-	2,886,647 gal./day
Avg. Daily Consumption (Res.)	-	1,181,006 gal./day
Avg. Daily Consumption (Comm. & Ind.)	-	1,587,136 gal./day
Avg. Daily Consumption (Unacc. Losses)	-	1,623 gal./day
Combined Well Pump Capacity	-	9,200,000 GPD
Total Storage Capacity	-	2,693,500 Gal.
% Avg. Day of Pump Capacity	-	33.9%

Appendix G lists the monthly industrial water and sewage consumption.

It is obvious that since the average daily flow is only 33.9 per cent of the pump capacity that the supply of water is not a limiting factor in the growth of Barrie.

C. Water Quality

Bacteriologically, the water is satisfactory. Appendix D lists the water quality criteria for public ground water supplies with the individual well results for the City of Barrie from samples obtained during 1971. A perusal of these results show that the well water though hard, is chemically satisfactory.

D. Storage

A system is considered to be adequate if it can deliver fire flow for the number of hours specified in Appendix C, Table 3, with consumption at the maximum daily rate; if this delivery is also possible under certain emergency or unusual conditions, the system is considered to be reliable.

Appendix C, Table 3 includes an empirical method for calculation of storage requirements for the present system in Barrie. A more than satisfactory result is obtained with the system having a surplus storage of 413,500 IG above the extremely strict Underwriters' requirements. Assuming all pumps are operative, a surplus storage of 1,853,500 IG is available.

E. System Expansion

All the system extensions and expansion to the water works is listed in Appendix J, with the projected works.

IV MUNICIPAL WATER POLLUTION CONTROL PLANT

A. Description of Works

The water pollution control plant serving the City of Barrie is capable of effecting secondary treatment to 3.0 MGD dry weather flow (DWF). The plant was designed to provide primary treatment for up to 3 DWF and complete treatment for up to 2 DWF.

The treatment plant, using the conventional activated sludge process, is designed for a raw sewage strength of 300 ppm or 9,000 pounds per day with respect to BOD and suspended solids, and a removal efficiency of 95 per cent. The design flow of 3.0 MGD is based on a design population of 30,000 (1977) which includes 350,000 to 400,000 gallons contributed daily by industry through the use of private wells. The plant is still subject to high industrial waste loading, including two leather companies. The brewery under construction is to have pre-treatment reportedly to meet the City's industrial waste by-law.

The plant's final effluent is chlorinated and discharged to Kempenfelt Bay.

B. Existing Sewer System

The area of the city on the north side of the bay, comprising approximately 2,800 acres is served by a 42-inch diameter trunk intercepting sewer that extends along the waterfront and drains to a sewage pumping station on the bay shore at the foot of Toronto Street. At the Toronto Street Pumping Station (T.S.P.S.) the grit is removed and the flow is screened and then pumped through approximately 3,500 feet of 16-inch diameter forcemain to the treatment plant site. At the pumping station, the screenings are shredded and returned to the sewage flow. The grit is washed and hauled

away. Flow measurement is provided by a weir in the inlet channel of the pump suction well.

The central western section of the city, approximately 890 acres in extent, is served by sanitary sewers draining directly to the sewage treatment plant. The flow from the Canadian General Electric and Barrie Tanning drains to the T.S.P.S.

The sanitary flow from the southerly section of the city, formerly Allandale and vicinity, comprising approximately 1,090 acres, is collected by the trunk sewer on Essa Road, which extends to the treatment plant and is joined by the flows from the southerly section of the sewer on Bradford Street.

C. Plant Flows

Appendix E, Tables 1 and 2 list plant flows for 1970 and the first six months of 1971. A summary of these flows is presented below:

	1970 (9 months)	1971 (6 months)
TOTAL	626.7 MG	509.6 MG
Maximum Day	3.9 MGD	4.3 MGD
Minimum Day	1.0 MGD	1.4 MGD
Average Day over same six months	2.7 MGD	2.8 MGD
% Average Day of Design Flow	90 %	93 %

The 1971 flows have increased slightly over the 1970 flows with a corresponding higher maximum day and average day. The average daily flow for the first six months of 1971 of 2.8 MGD represents 93 per cent of the design flow of 3.0 MGD, and illustrates that the hydraulic loading has not as yet reached the plant's design capacity. However, Formosa Brewery, which is to go into operation this year, is expected to discharge 0.3 MGD to the treatment plant. Although the average daily flow for 1971 will possibly drop in magnitude over the remainder of the year, as was the case in 1970, the plant will probably exceed its rated hydraulic capacity with the additional flow, at least for the first six months of the year.

Flow rates to the plant range around 4.5 MGD between the heavy flow period of 7:00 AM to 6:00 PM, and then drops off to below 2 MGD during the rest of the time.

It should be noted that the firm of Fischer and Porter re-calibrated the flow meter on April 5, 1971 and therefore the flows from March 30 through to April 5 may be erroneous.

D. Plant Loadings and Process Evaluation

(i) Raw Sewage

A list of the analyses results of 1970 and

part of 1971 of the raw sewage strength is presented in Appendix F, Table 3, from which an average summary is given below:

	T.S.P.S.		M.P.S.		Raw Sewage Combined	
	BOD	SS	BOD	SS	BOD	SS
1970	238	230	413	1071	409	738
1971	267	239	447	1052	385	577

From the above it can be seen that the organic strength has remained roughly the same. The average BOD and suspended solids concentrations of the raw sewage was 385 and 577 ppm, respectively, thus far in 1971. It should be noted that the raw sewage samples would contain waste activated sludge, and therefore the BOD and suspended solids may be higher than actual in the M.P.S. and combined results. The proposed waste sludge thickener and subsequent alterations will eliminate the return of waste sludge to the raw sewage, and a true loading may be calculated.

No waste sludge is returned to the T.S.P.S., and a major quantity of the industrial wastes flow to the T.S.P.S. therefore it seems reasonable to consider the sewage strength at the T.S.P.S. to be more realistic than the listed combined raw sewage strengths. Also, in August 1970, there was no wasting to the raw sewage entering the plant. The August results for the combined flow were very similar to the T.S.P.S. results at that time and to the normal T.S.P.S. sewage strength, which is lower than the combined strength. Therefore, it can be

anticipated that when renovations are made to the plant to exclude the waste activated sludge from the raw sewage, the organic loading to the plant will be reduced to say 250 ppm BOD.

Considering the present raw sewage organic strength at the average 385 ppm BOD and 577 ppm suspended solids with the average 1971 flow of 2.8 MGD, the present BOD and suspended solids loading to the primary tanks is 10,780 and 16,156 pounds per day, respectively. The plant was designed to handle 300 ppm or 9,000 pounds per day BOD and suspended solids, thus showing an organic overload. However, if the raw sewage strength is assumed to be roughly 250 ppm as the previously mentioned T.S.P.S. and August, 1970 results seem to indicate, then the organic loading drops to 7,000 pounds per day of BOD, which results in an estimated reserve capacity of 2,000 pounds per day from the point of view of raw sewage loading.

(ii) Primary Sedimentation

The existing primary sedimentation tank consists of an 80 foot diameter circular clarifier with rotating sludge and scum scrapers with a volume of 50,000 cubic feet or 312,000 gallons. The clarifier was designed for a detention time of 2.5 hours at design flow of 3.0 MGD with a surface settling rate of 600 GPD per square foot and a weir overflow rate of 12,000 GPD per linear foot.

From the 1971 monthly analysis results and the 1971 24-hour composite sampling results shown in Appendix F, Table 4, it can be seen that the average primary effluent BOD was approximately 230 ppm. On the basis of the 1971 flow of 2.8 MGD, the present BOD loading on the aeration tanks is 6,440 pounds per day. Again considering the raw sewage strength to be 250 ppm BOD, and using a 35 per cent primary reduction, the primary effluent can be estimated at 165 ppm BOD after the alterations. This would lower the present loading to 4,600 pounds per day at the present flow rate.

An additional primary clarifier is to be constructed shortly.

(iii) <u>Aeration</u>

The aeration section of the plant consists of two tanks in parallel,each with two passes, and a total volume of 155,000 cubic feet or 972,000 gallons. At design flow and including a return sludge rate of say 30 per cent, the nominal detention time is about 6 hours. The volumetric loading rate is 35 pounds BOD per 1000 cubic feet tank for a nominal loading of 5,400 pounds BOD per day.

The existing total blower capacity of the aeration tanks is 7.5 million cubic feet of air per day. Approval has been granted by OWRC for

the construction of an additional blower which is capable of supplying 3.31 million cubic feet of air per day. This blower should be in operation shortly, bringing the total blower capacity up to 10.86 million cubic feet of air per day. On the basis of 1,400 cubic feet of air per pound of BOD reduction, the total BOD loading to the aeration tank should not exceed 7,760 pounds per day. The 1971 sample results to date show an average primary effluent BOD of 295 ppm with an average flow of 2.8 MGD, which suggests the present BOD loading on the aeration tanks to be (2.8)(295) = 8,260 pounds per day. On the basis of the existing blower capacity a design BOD loading of 5,400 pounds per day is noted. This indicates that at the present time, the organic loading of the aeration tank is in excess of the design capacity.

In a report dated February 20, 1970, prepared by Gore and Storrie, Consulting Engineers, on the aeration tank capacity, it is stated that "providing there is sufficient air and sludge handling capacity and a slightly higher degree of control over the process, the tanks could satisfactorily handle 60 pounds BOD per 1000 cubic feet or 9,000 pounds BOD per day." According to the previous calculations on the BOD capacity of the aeration tank after the new blower is installed, a maximum loading of 7,760 pounds of BOD per day can be handled.

As was previously discussed, the actual loadings to the plant are quite difficult to determine since the waste activated sludge is being mixed with the raw sewage; however, due to the reasons mentioned under the raw sewage discussion, a raw organic strength of 250 ppm BOD with a subsequent primary effluent BOD of 165 ppm appears to be a more realistic assumption, once the plant revisions are complete. Based on this assumption, the organic load to the aeration tanks will be reduced to (165)(2.8) = 4,600 pounds per day at the 1971 average to date flow of 2.8 MGD. This would result in a reserve organic capacity of 3,160 pounds of BOD per day in the aeration tanks assuming that the new blower is operating.

Formosa Brewery is expected to go into operation this year, with a proposed average flow to the sanitary sewers of 0.3 MGD. It has been estimated that the average BOD loading to the sewers during the first year phase will be roughly 2,000 pounds per day. Since the brewery wastes have a high content of soluble BOD, the primary reduction will be lower than normal, say 25 per cent. The brewery has assured the city that the City of Barrie By-Law #66-69 limits will be met for the sanitary discharge. Therefore, a brewery effluent BOD of 300 ppm may be assumed for loading determinations. Using an average flow of 2.8 MGD plus the 0.3 MGD from brewery wastes, the following

organic loadings should be in evidence at 3.1 MGD while assuming the raw and settled sewage strengths to be 250 and 165 ppm, respectively.

	Loading Without Brewery Wastes	Loading With Brewery Wastes	Maximum Capacity	Reserve Capacity
Flow (MGD)	2.8	3.1		
Primary Loading (lb. BOD/day)	7000	7900	9000	1100
Secondary Loading (lb. BOD/day)	4600	5275	7760	2485

As can be seen from the above, there could be a reserve secondary capacity of almost 2500 pounds BOD per day. The proposed new primary clarifier will raise the primary capacity. On the basis of 0.17 pounds of BOD per person per day, the additional aeration capacity will be equivalent to slightly over 14,700 persons. A more precise determination of the reserve capacity of the aeration tanks can be made following the proposed changes in return sludge handling.

Comments have been made to the Department of Municipal Affairs on subdivision development in Barrie which could add roughly 9,000 persons to the existing population. This would leave a present reserve organic capacity for some 5,700 persons based on (a) the assumptions used in this report, (b) present plant performance, (c) the discussed renovations.

Following the implementation of these plant revisions, a closer estimate organic reserve capacity should be made. It should be pointed out that any changes in plant performance, flow, or present industrial conditions will nullify this estimate. Increased industrial loading will of course reduce reserve organic capacity available for residential development.

The average sludge age throughout 1970 and 1971 to date is 5 days, resulting in an average food to micro-organism ratio (F/M) of 0.2 or 20 pounds BOD per 100 pounds mixed liquor suspended solids (MLSS). The optimum loading for the conventional activated sludge process is felt to be near 0.3 pounds BOD per day per pound activated sludge with a range of 0.22 to 0.48 if the sludge volume index (SVI) is to be held under 100.

The average SVI, which is equal to (per cent settleable solids x 10,000/ppm suspended solids) over 1970 was 58 and 87 thus far in 1971.

The MLSS concentration is usually kept between 3,000 and 4,000 ppm with 30-minute settling tests of approximately 30 per cent. The MLSS concentration is maintained fairly high by the operator due to the high volume of industrial wastes reaching the plant.

(iv) Final Sedimentation

The existing final clarification stage is carried out by two rectangular tanks with longitudinal and cross sludge collectors. The tanks provide a total volume of

approximately 43,000 gallons, and were designed to effect a detention time of 3.5 hours at the design flow of 3.0 MGD.

The final settling tank in the activated sludge process has two functions: (1) The production of an effluent which is relatively free of settleable solids; and (2) the production of an underflow which contains, in high concentrations, the solids which have been settled in the tank. Both functions, clarification and thickening, must be considered in design if the tank is to satisfactorily accomplish both of its tasks.

Sufficient surface area must be provided in the final settling tank so that the hydraulic loading per unit area does not exceed the settling velocity of the slowest settling material which is to be completely removed. The present surface area of 6,080 square feet divided into the design flow results in a DWF surface settling rate of 493 gallons per day per square foot.

$$\text{i.e. } \frac{3,000,000}{6,080} = 493 \text{ gal./day/sq. ft.}$$

As was stated earlier, the flow rate from about 9:00 AM to 6:00 PM is roughly 4.5 MGD. Using this figure:

$$\frac{4,500,000}{6,080} = 740 \text{ gal./day/sq. ft.}$$

a surface settling rate of 1.5 DWF is obtained, which is quite satisfactory. Considering the peak flow of 6.0 MGD, a settling rate in the vicinity of 1,000 is evident, which is considered

a maximum for this size of plant.

If the brewery commences operation in 1971 the estimated flow to the sewage treatment plant will be 3.1 MGD. In addition to this we already have a potential population increase of 9,000 persons from subdivision proposals on which we have commented favourably to the Department of Municipal Affairs. This would increase the flow, when developed, assuming 85 gpcd, by about 0.75 MGD, to an estimated average flow of 3.85 MGD. From present data a flow rate of 6.2 MGD (3.85 x 1.6) could result during the hours of 9:00 AM - 6:00 PM. This will give a surface settling rate in excess of the recommended maximum of 1,000 gal./day/sq. ft.

The above does not include an allowance for increased industrial loading. It is noted that additional secondary clarification capacity is scheduled for completion in 1975. If a growth rate of about 2.2 per cent is assumed as in the Gore & Storrie report of February 20, 1970, it is possible that extra final clarification capacity may not be needed before 1975. However, the clarification capacity does appear to be a factor which could cause problems in accommodating a rapid increase in flow. The municipality should be in a position if necessary to construct the extra final clarification capacity before 1975.

From monthly average results, the quality of the final chlorinated effluent has been satisfactory. This may be due to two reasons. Firstly, the chlorine contact chambers following the final settling tanks are actually old clarifiers, which settle out any floc and return it to the plant. There is no data on the actual concentration of this carryover floc to the contact chambers. Also, all of the composite samples are on a 24-hour basis, and therefore average the higher and lower flow periods of the day.

(v) Sludge Digestion and Removal

The existing digesters consist of three separate anaerobic digesters providing a total capacity of 136,800 cubic feet. The original 40 foot diameter, 25,000 cubic foot digester has been out of service for 6 or 7 years, with the plant running on the two newer, 55 foot diameter, 55,900 cubic foot digesters since that time. Renovations to the original digester are to be completed very shortly. The floating cover was replaced with a static cover to provide a sludge holding tank. The new set-up increases the sludge holding capacity by 25,000 cubic feet, and provides three separate stages of digestion, i.e. mixing and heating, settling, and holding and withdrawing.

This new total volume results in a volume of 4.6 cubic feet per capita, based on the plant design population of 30,000. The digester sludge is removed by tank truck and disposed of on land near the municipal sanitary landfill site.

The following summary illustrates the average operating characteristics of the two digesters throughout 1970:

<u>Raw Sludge to Digesters</u>

(1)	Average	10,900 GPD
(2)	Total Dry Solids	4 - 5 %
(3)	Volatile Solids	70 - 75 %
(4)	Inorganic Solids	27 - 30 %
(5)	Loading Rate	0.5 lb. volatile solids/cu. ft. total dig. cap./day

<u>Digester Contents</u>

		#1	#2
(1)	Temperature (^{o}F)	90 - 95	75 - 80
(2)	pH	7.0	7.0
(3)	Volatile Acids (ppm)	270	350
(4)	Alkalinity (ppm)	2800	330

<u>Digester Sludge Removed</u>

(1)	Average	7,000 GPD
(2)	Total Dry Solids	4 - 5 %
(3)	Volatile Solids	60 - 65 %
(4)	Inorganic Solids	35 - 40 %
(5)	Reduction of Volatile Solids by Digestion	36 %
(6)	Reduction of Sludge Volume by Digestion	37 %

The success of digestion depends primarily and fundamentally on the reduction of the volatile content of the original sludge. The volatiles in a well digested sludge usually range from 40 to 50 per cent, but, volatile contents as high as 60 per cent, as is the case here, are not unusual.

In February, 1971, Technical Advisory Services recommended continuous wasting at a reduced rate, increased raw sludge pumping, increased hauling of digested sludge, and an increased return sludge rate. Prior to this action, approximately 11,000 GPD of raw sludge was pumped to the digester, with 7,000 to 8,000 GPD of digested sludge being trucked to the sanitary landfill site. Following the continual wasting, the raw sludge pumpage was increased to 18,500 GPD, while the digested sludge removed was approximately 18,000 GPD.

The percentage reduction in volatile matter varies with the original volatile content. The average reduction rates of volatile solids remains about 35 per cent, whereas a reduction rate of somewhere between 50 - 70 per cent should be possible with a raw sludge content of 70 - 75 per cent.

It should be noted that sludge disposal has become an increasing problem with the city. Also, once the brewery is operational, and they have used a limiting quantity for horticultural purposes on the grounds, there is going to be a great deal of additional sludge for disposal. The city

should continue the attempt to obtain new disposal sites which are satisfactory from pollutional and aesthetic aspects.

E. Plant Efficiency

Appendix F, Tables 1 and 2, list the analysis results or plant performance for 1970 and half of 1971. The 1970 results show average BOD and suspended solids concentrations in the final effluent to be 13 and 34 ppm, respectively, representing plant removal efficiencies of 97 and 95 per cent. The 1971 monthly results reveal average final effluent concentrations of 16 and 22 ppm for BOD and suspended solids, with BOD and suspended solids reduction of 42 and 62 per cent respectively, in the primary, and 96 per cent overall for both parameters.

This degree of plant performance may be considered satisfactory, although the suspended solids concentrations in the final effluent sometimes ranges a little high. Appendix F, Table 4, lists 24-hour composite sampling results for selected days in 1971. The average removal efficiencies for BOD and suspended solids on these days were 32 and 68 per cent respectively through the primary tank, and 97 per cent overall. From the above, it can be seen that the primary section of the plant is capable of removing between 30 and 40 per cent BOD, and roughly 60 per cent of the suspended solids, while the total plant achieves a removal of about 96 per cent. This again is satisfactory.

The proposed renovations should improve this performance, and a detailed plant study should be made following the revisions to determine the new plant efficiency.

F. Proposed Future Enlargements

Appendix J lists excerpts from the City's projected works program (1971 - 1975) pertaining to the sanitary and waste removal facilities and the storm sewers and watercourses.

(i) Water Pollution Control Plant

As discussed earlier, a new 2,300 cubic feet per minute blower will be operating soon. A new primary clarifier and a new raw sewage pumping station were slated for construction in 1971; however, it now appears that construction will begin early in 1972.

The new 'Simcar Electroflote' sludge thickening unit, is expected to be in operation very shortly. The waste activated sludge is pumped to the unit, from which the thickened sludge is pumped by a new concentrated sludge pump to the primary digester. The supernatant is then returned to the aeration tanks. The maximum flow rate is 39 GPM with the normal rate expected to be around 24 GPM.

A new 24-inch diameter forcemain from Toronto Street Pumping Station is to be constructed in 1972, with a new 2.5 MGD pumping unit for the Main Pumping Station in 1974. The

final settling tanks are to be increased in capacity by 50 per cent in 1975.

(ii) Sewerage System

As described in Appendix J, trunk sanitary sewers will be extended to the outer areas of the city over the next 3 years, including Edgehill Drive, Cundles Road, Patterson Road and Allandale Avenue.

Sanitary sewers are also to be extended, including Edgehill Drive to Ferndale Road. A substantial amount of storm sewers are also to be completed.

G. Nutrient Control

Since June, 1971, the Division of Research, Technical Advisory Services Branch has been carrying out a full plant scale treatability study of the sewage for nutrient removal. This study is being run on the basis of the Technical Advisory Services Branch providing the equipment and men, and the municipality supplying the required chemicals.

V WATER POLLUTION SURVEYS

A. Introduction

A water pollution survey of the City of Barrie was performed by the OWRC in 1965 and 1966, and a report prepared in 1966. At that time, samples were collected from Kempenfelt Bay, local inland watercourses, and all of the known discharges to these waterways. A follow-up investigation of the 1966

report was made in May, June, July and August of 1971. The purpose of this investigation was to update the past information and to locate and sample, if possible, all new sources or potential sources of significant flow to the watercourses and/or Kempenfelt Bay. The appendices contain the results of the samples from both surveys, as well as an interpretation of the laboratory analyses.

B. Past Survey Conclusions and Recommendations

The 1966 OWRC survey revealed that varying degrees of corrective measures were required at certain industries to overcome the significant contribution of industrial wastes to water pollution within the municipality and also to problems encountered at the water pollution control plant. It was concluded that storm sewers discharging industrial and/or sanitary wastes accounted for much of the pollution within the city. A considerable amount of sanitary wastes were gaining access to the streams in the concentrated area of the city.

The present municipal sanitary landfill site was not presenting any problem at that time with respect to water pollution, but leachate from an old landfill site located at Innisfil and Vespra Streets was gaining access to the stream at this point.

Generally satisfactory conditions were noted along the waterfront area in relation to the waste disposal facilities serving premises located near the water. One exception was the Speedy Bay Car Wash which discharged car

wash wastes to the Bay.

The following recommendations were made as a result of the 1966 survey:

1. The municipality should endeavour to locate and sever all connections to storm sewers where polluting materials are being discharged.
2. The eight industries, namely Canadylet Closures, Culligan Water Conditioners, DeVilbiss (Canada) Limited, C.V. Hill of Canada, Imperial Eastman, Lufkin Rule of Canada, Dufferin Materials and Construction Limited, and Universal Cooler Limited should take the necessary corrective action to eliminate the discharge of any inadequately treated industrial wastes to the watercourses or storm sewers, as recommended by the Division of Industrial Wastes of the OWRC.
3. The industries discharging industrial wastes to the sanitary sewers should be prepared to meet the waste discharge objectives of the industrial waste by-law.
4. Wastes from the three car washes i.e., the J.B. Car Wash, the Speedy Bay Car Wash, and the "Sop-Spra" Car Wash should be discharged to the municipal sanitary sewer system.

5. Measures should be taken at the old landfill site at Innisfil and Vespra Streets to prevent leachate from entering the stream.

C. Action Taken on 1966 Recommendations

1. City officials reported that to the best of their knowledge all sanitary and storm sewers were separated in the early 1960's. However, the 1971 sampling results will show that there still remains a substantial discharge to the sanitary sewers from illegal connections.

2. The Division of Industrial Wastes has been working closely with the City throughout the past few years in directing all such discharges to the sanitary sewers. A complete report prepared by the Division of Industrial Wastes in 1969 (Industrial Wastes Survey of the City of Barrie) gives a very comprehensive description of all the industrial processes in Barrie, and recommends any alterations needed. These recommendations have been conscientiously carried out by the City. The Division of Industrial Wastes keeps well abreast of all industrial operations within the City.

3. The City of Barrie maintains a close regulation of the quality of effluents discharged to the sanitary sewers under the By-Law #70-10.

4. The Division of Industrial Wastes and the City of Barrie report that all car wash wastes are directed to the sanitary sewers after recycling.

5. The City endeavoured to locate the origin of this leachate in the latter part of 1969 or early 1970 by driving pipes into the area. No gas or draining leachate was evident at that time; however, the City scraped off a section of the soil on the basis of it being a lense of material. No evidence of leachate was apparent after this action.

D. Water Pollution Survey Follow-Up: 1971

(i) Introduction

A follow-up sampling program of the 1966 survey, as well as the sampling and locating of new discharges, was made during the months of May, June, July and August of 1971. During this time, most points were sampled twice, and in some cases three times. Although two or three sampling runs are more reliable than a single grab sample, there still remains the question of the acceptability of the discharge quality at all times and in all weather conditions. The magnitude of this type of sampling is beyond the scope of this report. There are some cases, however, where the results do indicate that immediate action should be taken to correct them.

It is the purpose of this follow-up survey to

present the results to the municipality involved without too much delay. Each municipality is responsible for the quality of the water it is discharging from its sewers to various watercourses, and it is therefore considered that having been provided with these preliminary results, the municipality should now initiate the appropriate action to remedy the situation and ensure themselves that their sewer discharges are of acceptable quality, i.e., within the limits set out in the City By-Law #70-10. Appendix H, Tables 1 through 9 list the 1971 results as well as the previous 1966 results. A brief sampling point description is given with each result, and with aid of the enclosed map all of the sampling points may be located in the field. A total of 145 sampling points are listed, of which 82 were sampled.

(ii) Photographs

Interspaced throughout the following sample result discussion are photographs taken during the same period, to illustrate some conditions more clearly, and to provide the aesthetic aspects of certain cases much better than a sample word description. All of these photographs were taken by OWRC personnel on the specified dates.

(iii) Analytical Interpretation

Chemical and bacteriological results were obtained for each point sampled. In most cases the chemical

analyses requested were BOD_5, total, suspended, and dissolved solids, and nutrients, while total coliform and fecal coliform determinations were requested on the bacteriological samples. More comprehensive chemical analyses were obtained where necessary.

Although, as stated before, one, two, or three sampling runs are restricted in their reliability, the results must be compared to some limiting standard. By-Law #70-10, passed by the City of Barrie, pertains to discharges to storm sewers and watercourses, and therefore these limits will be used to determine whether a discharge is satisfactory or not. This by-law is essentially the same as OWRC's model by-law.

There is a discrepancy, however, in the By-Law's microbiological criteria. In 1970, the OWRC updated its 1967 criteria, and recommended the following:

> "Water used for body contact recreational activities should be free from pathogens including any bacteria, fungi or viruses that may produce enteric disorders or eye, ear, nose, throat, and skin infections. Where ingestion is probable, recreational waters can be considered impaired when the coliform, fecal coliform, and/or enterococcus geometric mean density exceeds 1,000, 100 and/or 20 per 100 ml. respectively, in a series of at least

ten samples per month, including samples collected during weekend periods."

The model by-law adopted by the City governing discharges to storm sewers or watercourses contained the previous limit of 2,400 coliforms per 100 ml. Therefore, it is recommended to the City that By-Law #70-10 be amended to contain the new microbiological criteria as set out on page 24 of 'Guidelines and Criteria for Water Quality Management in Ontario.'

As a note of explanation, the original count of 2,400 was a figure adopted by the Department of Health in 1946. The intent of that figure at that time was different from the general use today and was very inexplicit as to how a spread of coliform counts were to be considered. The 2,400 figure was replaced with the geometric mean of 1000 , which incorporates counts higher or lower than that one figure, and allows a more representative result, as long as the 10 samples are obtained within the same period of time, such as the recommended month. Due to the magnitude of such sampling in the case of this report, the sample results available will have to represent the geometric mean. As explained earlier, this lowers the confidence level of the results, however, some standard criteria must be used. Therefore, in the following sample results interpretation, the By-Law #70-10 chemical criteria, and the OWRC microbiological criteria will be used

as the respective limits.

(iv) Sample Results and Interpretation

Eighty-five points of discharge or potential discharge to the watercourses or Bay are shown on the attached map and listed in Appendix H, of which significant flow was found and sampled at 22 points. Fourteen points were accessible for sampling. Eleven of the 22 discharges were found to be unacceptable according to the criteria discussed earlier.

These unacceptable discharges are presented below:

Storm sewer discharges KB-2-W, KB-8-W, KB-11-W and SA-0.76-W, contain high coliform densities, and low BOD values except for KB-8-W which does have a significant BOD of 8.5. Since the fecal coliform counts are equal or close to the total coliform density, there is the definite indication that domestic sewage is being directed to these sewers. When the coliform counts are low, ie., approximately 300 or 400 but equal for total and fecal, as is the case with KB-11-W, the cause would appear to be a continuous discharge of a limited nature. This is possibly one or two sanitary connections to the storm sewer feeding continuously. Regardless, there is definitely some illegal connections to these storm sewers, and appropriate action should be taken by the City to locate and direct these discharges to the sanitary sewers. The storm sewer KB-8-W extends under the marina at that point to discharge into the Bay. There have been numerous complaints of alleged raw sewage in this area of the

Bay, with a few cases of eye infections, etc. City officials are aware of this situation and are investigating. The City has issued a work order to remove the present sewage pump-out facilities from the dock, and pump the sewage directly to the wet well at Toronto Street Pumping Station. This should be completed very shortly.

The industrial discharge from Robson Lang Leathers, KB-5-I, was sampled on four different dates. The first two samples were acceptable except for high coliform counts. The third sample, taken on July 27, 1971, was obtained immediately following a pollution complaint of red material running into Kempenfelt Bay near Centennial Park. The discharge, as shown in the photograph below, showed evidence of a rust coloured material.

Sampling Point
KB-5-I
Discharge from
Robson Lang
Leathers
July 27, 1971

A sample obtained from Kempenfelt Bay by a citizen at the time of the complaint, contained a BOD level of 3.5 ppm and the red material was identified as iron oxide and/or hydroxide. The Robson Lang outfall discharges to a sewer that empties into Kempenfelt Bay at Centennial Park. The sample results at this time indicated a significant BOD level, 75 ppm ether solubles, 2.6 ppm chromium, high suspended solids, a pH of 9.5, and a temperature of 104°F. Another sample was taken on July 29, 1971. The discharge at this time had a greenish, murky appearance, as shown below. The analysis

Sampling Pt. KB-5-I
Discharge from Robson Lang
Leathers July 29, 1971

results revealed equal total and fecal coliforms, 17.5 ppm chromium, and a temperature of 99^{o}F. Both of these samples exceed the By-Law #70-10 limits, and OWRC objectives. City officials reported that they had been sampling the Robson Lang effluent and were about to take action in eliminating the pollutants from this discharge.

The ditch sampling point D-B-1, shown in the photograph below, contained brown, oily material that appeared

Sampling Pt. D-B-1
Ditch in front of British Peacock
Petroleum along Ferndale at Dunlop

to have flowed along the ditch and then became relatively stagnant, except for a small drain to Tributary B of Stream B. This material, as can be seen from the photo, is very unsightly, and contained 42 ppm BOD. The personnel at British Peacock explained that during the winter, the fuel oil trucks park up against the office building near the electrical outlets. During this time, fuel oil drips off the trucks and drains into a catch basin. In the spring, this material is flushed into the ditch, and continues to drain into the stream. Judging from the coliform counts, and high free ammonia concentrations, there appears to be some domestic sewage pollution as well. The City should ensure that this type of occurrence is eliminated.

Sampling point D-B-2 is a drainage area behind Simcoe Petroleum near Anne and John Streets. This area contains a substantial amount of oily material, that was identified by the OWRC Lab as 70 ppm high boiling petroleum fraction, possibly similar to a laboratory oil or paraffin oil (Nugel or lube oil). This material drains into Stream B, just below sampling point SB-0.64, as shown in the photograph below.

4

Sampling Pt. D-B-2
Drainage area behind Simcoe
Petroleum, draining to Stream B

The origin of this material is uncertain. There is an abandoned service centre at the corner of John and Anne Streets, with underground tanks. It is possible some of this material may be from this site, as well as the Simcoe Petroleum site. There have been numerous complaints of oil in Stream B, which collects further downstream at SB-0.28.

The origin of this material should be located and prevented from gaining access to the stream. The immediate area may have to be cleaned out also to remove the existing material.

Sampling point D-C-2 contains oily wastes and refuse including used oil cans, etc. The dark brown viscous oil extracted from the sample and examined by infrared spectroscopy, was found to be characteristic of a used or aging paraffin base petroleum lubricating oil. This area is located on the bank of Stream C behind D. Moran Construction just downstream of sampling point SC-0.57. This type of refuse and oil wastes should not be dumped in the vicinity of the stream.

The discharge from Dangerfield Motors, sampling point SA-0.19-P-2, on May 11, 1971, contained what appeared to be some sort of wash wastes. The chemical analysis showed a high BOD value, high suspended solids, and an ABS level of 0.8 ppm, all of which exceed the criteria objectives. Throughout the survey period, oil was noticed in the stream immediately downstream of the Dangerfield outlet, however none was apparent upstream of the point. SA-0.19-P-2 discharges inside a culvert near the WPCP, and municipal employees noted this occurrence many times. This discharge as well as SA-0.19-P-1 should be sealed off and the waste directed to the sanitary sewer.

A 12-inch diameter concrete outlet from Lufkin Rule of Canada, sampling point SB-0.41-I, discharges to Stream B. The coliform concentrations were 2,800 and 2,000 for total and fecal coliforms, respectively. The free ammonia was high, indicating that the domestic sewage in the discharge was fresh or of a recent nature. The cause of this pollution should be located and directed to the sanitary sewer.

The industrial outlet, sampling point SC-0.24-I, from Canadian General Electric, drains to Stream C. Although the rest of the outlets from C.G.E. appear to be acceptable, this one discharge contained an equal count of total and fecal coliforms in one sample. The possibility of limited domestic sewage gaining access to this outlet should be checked and rectified if necessary.

Throughout the survey, 60 stream sampling points were sampled. Sample results from the five streams indicated that 7 out of 9, 12 out of 17, 15 out of 18, 5 out of 6, and 4 out of 4 points from Streams A, B, C, D, and E, respectively, were unacceptable based on the discussed criteria.

Considering Stream A, the sample results indicate high coliform densities with high fecal pollution also. The surprising aspect of the results is that at sampling point SA-1.50, which is at Patterson Road, above the city, the counts are

3,800 and 1,900 for total and fecal coliforms respectively. One apparent reason for this could be septic tanks in the area. The City has slated a sanitary trunk sewer for that area in 1972. It is hoped this will rectify the problem, for there isn't much difference between the source and outlet of Stream A as far as microbiological pollution is concerned. The photographs below, illustrate the physical difference in the stream's appearance, at SA-1.50 and SA-0.00, at Kempenfelt Bay.

Sampling Pt. SA-1.50
Stream A - south of Patterson Road

Sampling Pt. SA-0.00
Stream A - outlets to Kempenfelt Bay

It appears that a large portion of the microbiological pollution is coming from the storm sewers that discharge to the stream, which also is the case with the other streams. Stream A sample results taken on the same day, reveal fairly high constant coliform counts all the way down the stream.

Stream B is similar to Stream A, with slightly lower total coliform counts, however the fecal counts are still high. The free ammonia concentrations are high all along the stream, indicating that the continuous discharge of

domestic sewage from a few house connections is of a recent nature, i.e., the sewage is relatively fresh and has not come a long way. Again, the proposed sanitary sewers for this area may alleviate the condition; however, the location and corrections of illegal connections should be made.

Another, but just as unacceptable, type of pollution along Stream B can be seen in the following pictures.

Stream B - behind
Simcoe Petroleum just downstream of SB-0.64

Stream B - behind
Simcoe Petroleum just downstream of SB-0.64

Impaired water quality conditions can result because of the contact of solid wastes with water. Situations such as those depicted above can degrade the quality of the water and affect the aesthetic values of the stream. The debris and oily wastes that are carried by Stream B, collect at sampling point SB-0.28,

shown below.

Sampling Pt. SB-0.28
Collection of refuse and oil wastes

It should be pointed out that during the survey period, the City cleaned up many of the above cases; however, there still remains quite an amount of refuse near the stream on private property which was not removed. These individual should be instructed to remove the polluting

material from the stream area. Stream B, emptying into Kempenfelt Bay, is shown below.

10

Sampling Pt. SB-0.00
Stream B at Kempenfelt Bay

Stream C also has high coliform counts, although not nearly as bad as Stream A and B. Samples of Tributary A of Stream C above and below the plaza, at sampling points SCTA-0.83 and SCTA-0.95, strongly indicate the presence of domestic sewage in the stream. Malfunctioning septic tanks are most likely causing high coliform counts in the upper end of Stream C at Edgehill Drive, since the ditches in that area appear to contain some septic tank waste. The

proposed sewers for this area will most likely correct the problems. The section of Stream C from Dunlop south to just below Perry Street, has high total and fecal coliform counts indicative of domestic sewage. This may be due to the storm sewers in this area, which are inaccessible for sampling, having a few domestic sewage connections. As a check on the old landfill sites that were located along the stream, extensive analyses were requested from sampling points SC-0.79 and SC-0.28 which are upstream and downstream of the old site. The sample results, listed on Appendix H, Table 5, indicate some increase in chemical characteristics indicative of landfill site waste; however, the levels are not significant indications of pollution.

The two photographs below illustrate pollution and/or potential pollution from solid wastes piled behind French Motors on Bradford Street.

Vicinity of Stream C - Refuse dump behind French Motors on Bradford Street

12

Stream C - just behind
French Motors on Bradford Street

Reportedly the owner is attempting to reclaim land; however, the type of refuse being used includes oily wastes, which is a definite pollution hazard. This type of waste material should be removed from the area and all future refuse of this type sent to the sanitary landfill site.

The following two photographs depict oil wastes at sampling point SC-0.20 and Stream C just before Kempenfelt Bay.

13

Sampling Pt. SC-0.20
Stream C at Bradford Street

14

Sampling Pt. SC-0.00
Stream C - just before Kempenfelt Bay

Stream D follows the trend of the previously discussed streams with acceptable BOD levels and unacceptable coliform counts. Sampling point SDTA-0.76 shows evidence of domestic sewage in the same area as the previously mentioned SCTA-0.95, near Wellington Street. The coliform counts increase progressively from the beginning of the stream. There most likely is leaching from tile fields in this area between Donald and Wellington Streets. The photograph below shows one of a few instances of the stream foaming.

Sampling Pt. SD-0.56

Stream D at Donald Street

A check should be made in this area for septic tanks and tile fields discharges. The two pictures below show Stream D upstream and downstream of the City.

Sampling Pt. SD-1.45
Stream D upstream of City

Sampling Pt. SD-0.00
Stream D at outlet to Kempenfelt Bay

Stream E also has some high total coliform counts, however, the fecal pollution is not too significant except at the outlet of the stream to Kempenfelt Bay.

E. Sanitary Landfill Site

The location of the sanitary landfill site is shown on the appended map. The site has been in operation for approximately 10 years. All types of waste are trucked to the site, including various industrial wastes. Sludge disposal is carried out on the western section of the site on fields where it is ploughed in.

The first indication of any problems with the site was from citizen complaints in the area of Edgehill Drive. The source of Stream B, discussed in the previous section, exists just inside the entrance to the landfill site. The residents noticed the stream becoming more and more polluted. The following photographs show the physical appearance of the stream at the indicated points. The first picture is of the junction of the polluted Stream B with a

Stream B - Junction
of Tributary A with Stream B

tributary that originates east of Stream B. This tributary is of satisfactory quality and serves to dilute the strength of pollutants in Stream B. The photograph below is just downstream of this junction.

Stream B - just downstream of
junction of Tributary A

The next photograph is the same Stream B at Edgehill Drive, approximately 1,500 feet from the entrance road to the landfill site.

20

Sampling Pt. SB-2.67
Stream B at Edgehill Drive

The appended sample results listed in Appendix H, Tables 8 and 9, show the extremely high levels of pollution along this stream, that extends through the City to discharge into Kempenfelt Bay. Whether the leachate affecting the stream is from an old deposit of buried refuse near the entrance, or the present landfill operation, or the sludge

disposal site, is not as yet known.

Commission staff from the Surveys and Projects Branch of the Division of Water Resources are presently making site investigations along with Triton Engineering, consultants hired by the City of Barrie, to determine exactly where the leachate is coming from and what may be done to eliminate the leaching. It is obvious that something must be done to stop the gross pollution to the stream.

Sanitary landfill studies have shown that chloride, sodium, specific conductance, and total and calcium hardness were the inorganic parameters of ground water quality which could be used most effectively to denote any changes attributable to leachates from the disposal area.

If leaching of a landfill does occur, it has been shown that the ground water in the immediate vicinity can become grossly polluted and unfit for human or animal consumption, or for industrial and irrigational use. Where essentially anaerobic conditions exist in a landfill, the decomposition of organic matter results in the formation of gases, principally methane, carbon dioxide, ammonia and hydrogen sulphide. Carbon dioxide, due to its high solubility combines with water to form carbonic acid and will dissolve iron from tin cans and lime from calcareous materials and deposits.

Two actual cases of pollution of ground water supplies traceable to leachates from garbage dumps extended from 0.25 to 0.80 miles away. Other actual cases have shown that even after 15 years of storage and decomposition, certain wastes can still cause troublesome water pollution problems.

The area in which the stream originates is a natural, low lying drainage area. Appendix I, Tables 1 and 2, illustrate the contours of the landfill site area before the operation, and with the existing site located. It can be seen from these, as well as aerial photographs taken before the site was in operation, that a natural drainage route exists right through the present site down to the swampy area mentioned. The low area is saturated with this leachate, causing a very disagreeable stench. Test hole sample results obtained by the City indicated BOD levels ranging from 200 to over 300 ppm. Judging from the results, these concentrated leachates are of very high pollutional strength, comparable to industrial waste flows and the OWRC and the City of Barrie by-laws would not tolerate the discharge of a material like this untreated into a surface body of water.

In most of the research articles examined, the chloride concentration in the leachate directly below the landfill was always extremely high, however, the chloride

concentration dropped drastically in water samples taken only a short distance from the landfill operation, as the results substantiate here.

For unconsolidated materials of coarse sand and gravels with high permeabilities such as the case in Barrie, the protective mechanism breaks down because of one important reason, that is, time. There is much less time available for the degradation process to take place within the vicinity of leachate generation because the underground velocities are much higher. Thus, partially 'treated' and poorly diluted leachates can appear at greater distances from the landfill. Many industrial wastes can impart odour, taste and even toxic problems to ground waters at extremely low concentrations.

If it is true that the main landfill site is causing the leachate, some method must be found to treat or remove the polluting material. One possibility is the directing of the polluted stream to the sanitary sewers for treatment at the WPCP, allowing the clean stream to continue to flow. Since a sanitary trunk sewer is to be extended to the area, this should not be too difficult. If there is no other solution, the landfill site will have to be closed, along with elimination of the leaching.

The City should immediately begin to consider a new site for the operation in case it is necessary. At

the time that a new one is needed, hydrogeologic and hydrologic data should be used for the evaluation of the new site. Much useful information can be obtained even with a modest amount of field testing.

F. Snow Dump Site

The City of Barrie disposes of the snow ploughed off streets in the winter on the site shown below. This is located just off Kempenfelt Drive, just north-east of the foot of Tiffin Street.

City of Barrie Snow Dumpsite

VI DISCUSSION

A perusal of the sample results listed in Appendix H indicate that there are continuous discharges of domestic sewage of a limited nature gaining access to the storm sewers and watercourses. Possibly there are a few illegal connections to the storm sewers feeding continuously. The City should endeavour to locate and sever these connections. The industrial discharge from Robson Lang Leathers should be investigated and direction given to the firm that all polluting material is to be directed to the sanitary sewer, and not allowed access to the outfall discharging to the Bay. The Division of Industrial Wastes will be investigating this further and taking some action.

It should be pointed out that the City of Barrie has already started action on many of the pollution sources noted. Mr. Ray Allen, City Engineer, was advised of the sample results as the survey progressed, and subsequently investigated the situations. The City also made an extensive effort to clean up the streams. Refuse was removed from most of the streams by work crews and hauled away to the sanitary landfill site. It is anticipated that swift action will be taken on the pollution aspects of this report, as was the case during the survey period.

No conclusion can be made on the landfill site situation until the present field testing is completed. However, as stated before, the City should begin looking for a new site location.

By comparing the latest survey results with the previous survey results, it is quite obvious that a definite improvement has been made, in most cases, to the water quality of the watercourses. This has been largely dependent on the City's conscientious program of water pollution abatement.

VII PROJECTED WORKS PROGRAM : 1971 to 1975

Appendix J, illustrates a segment of the municipality's projected works program for the years 1971 to 1975. Waste removal, storm sewers, sanitary sewers, and water works are covered.

VIII SUMMARY AND CONCLUSIONS

The supply of water is not a limiting factor in the development of Barrie, since the combined well pump capacity is 9.2 MGD, while the 1970 combined average daily flow was 2.9 MGD or 108 GPCD. The pure residential demand of 44 GPCD represents 41 per cent of the total water consumption.

The 1971 average daily sewage flow over the first six months is 2.8 MGD, which is 93 per cent of the design flow of 3.0 MGD. The addition of Formosa's 0.3 MGD will put

the plant over its hydraulic capacity. However, the City has a schedule for extensions to provide additional capacity.

Determination of the organic loading on the plant is quite difficult due to the waste activated sludge being mixed with the raw sewage prior to the treatment plant. Assuming an actual raw sewage strength of 250 ppm BOD, once the revisions are completed, the organic loading to the plant will be 7,900 and 5,275 pounds BOD per day for primary and secondary loadings respectively at 3.1 MGD with the brewery wastes. This leaves a reserve organic capacity equivalent to 14,700 persons. Favourable comments on subdivision proposals has been sent to DMA for approximately 9,000 persons. A closer evaluation of the whole plant will have to be made following the completion of the plant revisions. The 1971 monthly results indicate BOD and suspended solids reductions of 42 and 62 per cent respectively in the primary and approximately 95 per cent overall for both parameters.

The 1971 water pollution survey results indicate that there are continuous discharges of a limited nature of domestic sewage gaining access to the storm sewers through illegal connections. Also, it appears that malfunctioning septic tanks are part of the reason for relatively high

microbiological pollution in all of the inland watercourses. The City should endeavour to locate and cut off any such connections. A few unacceptable industrial discharges were sampled, which will have to be rectified. On the whole, a definite improvement can be noticed from the previous survey results to the 1971 survey results.

Investigations of the sanitary landfill site are now underway. Following these field studies, some solution must be decided upon to stop the gross pollution of the stream from leachates.

The City's projected works program for 1971 to 1975, should upon completion, take care of quite a few sewerage problems.

Following council's review of this report, a meeting should be held with council, or an appropriate committee of council.

IX RECOMMENDATIONS

1. Following the completion of the current sewage treatment plant renovations, a detailed evaluation of the plant should be made, to obtain true loadings, and subsequently the plant's status so as to provide adequate treatment capacity for future development in the City.

2. The present investigations of the sanitary landfill site should proceed as quickly as possible to enable a solution to be found to the gross stream pollution from leachate. It is advised that the City begin looking for an alternate site immediately in the event that this is needed.
3. The City should proceed to rectify the sources of pollution as pointed out in the 1971 water pollution survey.
4. The City of Barrie's By-Law #70-10 should be amended to update the microbiological criteria to the present OWRC criteria.

Prepared by:..James Pauze...........................
for J.D. Snider, Technologist
District Engineers Branch
Division of Sanitary Engineering

/cs

APPENDIX A

CITY OF BARRIE

MUNICIPAL WATER WORKS

PHYSICAL DESCRIPTION

GENERAL

Six drilled deep wells with depth ranging from 70 to 348 feet are the sources of supply.

Check valves at an approximate elevation of 380 feet divide the distribution system into a low level and a high level area. Well pumps supply water to reservoirs except for John Street well and Wood Street well which pump directly to the distribution system. High lift pumps draw from reservoirs to supply the low level system and a 1,500,000 gallon concrete reservoir. All pumphouses have been designed to enable high lift pumps to operate simultaneously if the demand requires. Five booster pumping stations are provided (Anne Street, Codrington Street, Bayview Park , Innisfil Street and standpipe booster stations). Also a new booster station is proposed on Bayview Drive at Little Avenue.

Chlorination and sodium silicate treatment are provided to prevent occurrence of red water problems in the distribution system.

APPENDIX A - (Cont'd)

DETAILS - WELLS

WELLS	CONSTRUCTION	DEPTH (feet)	PUMP RATED CAPACITY (gpm)
Mary Street	26-inch Outer Casing 14-inch Inner Casing 8-inch Suction	127'	1000
Bayview Park	26-inch Outer Casing	70'	1000
Anne Street	16-inch Inner Casing	219' - 8"	1000
Perry Street	8-inch Suction	184'	1000
John Street	22-inch Outer Casing 12-inch Inner Casing 8-inch Suction	348'	1200
Wood Street	26-inch Outer Casing 16-inch Inner Casing	235'	1200
			6400 gpm or 9.2 MGD

All wells are provided with air lines to measure the static and operating water levels.

Storage

LOCATION	TYPE	CAPACITY (gallons)
Mary Street	1 - round concrete reservoir	103,500
	1 - square concrete reservoir	357,000
Bayview Street	1 - concrete reservoir	500,000
Anne Street	1 - 3 section concrete reservoir	40,000
Perry Street	1 - concrete reservoir	40,000
Anne Street	1 - concrete reservoir	1,500,000
Letitia Street	Standpipe	153,000
	TOTAL	2,693,500

APPENDIX A - (Cont'd)

EQUIPMENT DETAILS

1. Mary Street Pumping Station

Well Pumping Equipment

1 - Layne deep well, 2 stage turbine pump rated at 1000 gpm, driven by a 40 HP, 1750 RPM US Holloshaft electric motor or a 6 cylinder Continental gasoline engine. The pump output is 800 gpm.

High Lift Pumping Equipment

1 - De Laval, 2 stage centrifugal pump, rated at 450 gpm at 240 foot head, driven by a 50 HP, 1750 RPM, English electric motor. The pump has an output of 800 gpm.

1 - De Laval, 2 stage centrifugal pump, rated at 450 gpm at 240 foot head, driven by a 100 HP, 1750 RPM, English electric motor. The pump has an output of 900 gpm.

1 - De Laval single stage centrifugal pump which produces 1100 gpm at 1400 RPM and is capable of producing 1600 gpm at 1575 RMP. The pump is driven by a GM 6-71 diesel engine.

Standby Generator

A fully automatic gasoline engine drives the generator with the occurrence of power failures. The generator supplies power to all parts of the Mary Street Pumping Station.

Treatment

Chlorine

1 - W & T semi-automatic, V-notch gas chlorinator, Model A-741, with an orifice capacity of 0 to 50 lbs./24 hrs. The chlorine is applied to the suction well of the high lift pumps.

APPENDIX A - (Cont'd)

Sodium Silicate @ 28.7% silica

1 - W & T hypochlorinator, Model A-741. The sodium silicate is injected to the well pump discharge.

2. Bayview Park Pumping Station

Well Pumping Equipment

1 - Layne deep well 2 stage turbine pump rated at 1000 gpm against a head of 126 feet, driven by a 50 HP US Holloshaft electric motor or a 6 cyclinder Chrysler engine.

High Lift Pumping Equipment

2 - vertical shaft , single stage Allis-Chalmers centrifugal pumps rated at 750 gpm at 200 foot head, driven by 60 HP, GE vertical shaft motors.

1 - horizontal shaft, single stage Allis-Chalmers turbine pump rated at 1200 gpm at 200 foot head, driven by a 6-cylinder Cummings diesel engine.

A standby generator is provided to supply control power.

Treatment

Chlorine

1 - W & T, V-notch semi-automatic gas chlorinator, Model A-740014 with an orifice capacity of 0 to 20 lbs./24 hours, with discharge to the discharge of the well pump.

Sodium Silicate at 28.7% silica

1 - W & T hypochlorinator, Model A-417, injection into the discharge side of the well pumps.

APPENDIX A - (Cont'd)

3. Anne Street Pumping Station

Well Pumping Equipment

1 - Layne 2 stage turbine pump rated at 1000 gpm at 126 foot head, driven by a 50 HP US Holloshaft motor.

High Lift Pumping Equipment

1 - Layne 3 stage turbine pump rated at 1000 gpm at 189 foot head, driven by a 100 HP, US Holloshaft motor.

Treatment

Chlorine

1 - W & T semi-automatic gas chlorinator, Model A-731, with an orifice capacity of 0 to 50 lbs./24 hours. The chlorine is added to the suction side of the high lift pump.

Sodium Silicate at 28.7% silica

1 - W & T semi-automatic hypochlorinator, Model A-417, with injection into the well pump discharge.

4. Perry Street Pumping Station

Well Pumping Equipment

1 - Layne 2 stage turbine pump rated at 1000 gpm driven by a 40 HP US vertical Holloshaft motor.

High Lift Pumping Equipment

1 - Layne 3 stage turbine pump rated at 1000 gpm, driven by a 75 HO Holloshaft motor.

Treatment

Chlorine

1 - W & T semi-automatic V-notch gas chlorinator, Model A-731 with an orifice capacity of 0 to 50 lbs./24 hours, with discharge to the pressure side of the pump.

Sodium Silicate at 28.7% silica

1 - W & T hypochlorinator, Model A-417 with injection to pressure side of the pump.

5. John Street Pumping Station

Well Pumping Equipment

1 - Layne 6 stage centrifugal pump, rated at 1200 gpm at 252 foot head, driven by a 100 HP US Holloshaft electric motor or an 8-cylinder Buick gasoline engine.

Treatment

Chlorine

1 - W & T semi-automatic V-notch gas chlorinator, Model A-741 with an orifice capacity of 0 to 50 lbs./24 hours, with injection to the discharge side of the pump.

Sodium Silicate at 28.7% silica

1 - W & T hypochlorinator, Model A-417, with injection to the discharge side of the pumps.

6. Wood Street Pumping Station

1 - Layne 6 stage centrifugal pump rated at 1200 gpm at 252 foot head, driven by a US Holloshaft electric motor rated at 100 HP at 1775 RPM or an 8-cylinder 364 cubic inch Buick gasoline motor.

APPENDIX A - (Cont'd)

Treatment

Chlorine

1 - W & T semi-automatic V-notch gas chlorinator, Model A-741 with an orifice capacity of 0 to 50 lbs./24 hours, with injection to discharge side of the pump.

Sodium Silicate at 28.7% silica

1 - W & T hypochlorinator, Model A-417, with injection to discharge side of the pump.

BOOSTER STATIONS

1. Codrington Street Booster Station

This station takes the water from the low area at the 12-inch main at Berezy and Cordington Streets, and discharged into the high area through a 10-inch main into the northern part of the city, and also into the 8-inch Codrington Street main.

Pumping Equipment

1 - Allis-Chalmers horizontal centrifugal pump rated at 720 US gpm at 152 foot head, driven by a 50 HP Westinghouse electric motor.

1 - Allis-Chalmers horizontal centrifugal pump rated at 500 gpm at 140 foot head, driven by a 30 HP, GE motor or a Dodge gasoline engine. The pressure is increased from 24 to 90 psi by this station. A by-pass check valve is provided to prevent excessive pressures.

2. Anne and Letitia Streets - Booster Station

This station takes water from the low area at the Anne Street reservoir and discharges into the 12-inch Anne Street main at Letitia Street.

APPENDIX A - (Cont'd)

Pumping Equipment

1 - Aurora pump rated at 600 gpm at 140 foot head driven by a 20 HP, "A.C", 575 VAC at 1750 RPM.

1 - horizontal, centrifugal "Allis-Chalmers" pump rated at 500 IGPM at 140 foot head. This is a dual drive pump driven at one end by a 30 GP "A.C", 1750 RPM, 575 VAC electric motor. The other end is driven through a centrifugal clutch by a 2 cyl., GM 53 series diesel engine. The standby engine also drives a small standby generator to operate the pressure and flow transmitters during power interruptions.

1 - De Laval pump capacity unknown driven by 40 HP English electric motor.

3. Innisfil Street Booster Station

This station takes water from the 8-inch Innisfil Street main and discharges into the high area.

Pumping Equipment

1 - Allis-Chalmers horizontal centrifugal pump rated at 125 gpm at 115 foot head, driven by 7 1/2 HP, GE motor. A by-pass check valve is provided to prevent excessive pressures.

1 - Allis-Chalmers horizontal centrifugal pump rated at 300 gpm at 140 foot head, driven by a 20 HP Allis-Chalmers electric motor.

1 - Allis-Chalmers horizontal centrifugal pump rated at approximately 550 gpm, driven by a 40 HP English electric motor at one end, and by a 6 cylinder International gasoline engine at the other by means of a centrifugal clutch.

1 - Standby engine, 1958 International engine purchased October 22, 1970 for supplying sufficient power to the system. The horsepower is unknown but a displacement of 240 cu. inches is recorded.

APPENDIX A - (Cont'd)

4. Bayview Drive Booster Station

The station is installed underground and increases the pressure through a by-pass beside the Bayview Drive main. A by-pass pressure relief valve which opens at 80 psi is provided. A check valve is also provided in the main so that supply of water to the area is continued should the pump stop. This station is now used as a fourth stage for Innisfil Booster Station and is controlled by Innisfil Booster demand.

Pumping Equipment

1 - Layne "in-line" submersible single stage turbine pump driven by a 15 HP US electric motor.

Standpipe Booster Station

This station utilizes the storage facilities of the 153,000 gallon tank that was formerly used as a standpipe. The tank is filled during the night from the high level area and pumped back into the high area system when required during peak demand.

Pumping Equipment

1 - Weinman centrifugal pump rated at 600 US gpm at 141 foot head, driven by a 30 HP Brook electric motor.

CONTROLS

General

All the pumping stations are fully automatic and are controlled by a master control panel at the Mary Street Pumping Station with signals to and from the panel transmitted through Bell Telephone signal channels.

Control Panel

The selection of pumps, standby engines and

APPENDIX A - (Cont'd)

valves may be made by use of patch cords.

The panel includes pressure recorders, flow recorders and totalizers, valve position indicators, and liquid level indicators for the reservoirs.

An alarm system which indicates the area of low pressure is provided. The signal is transmitted to the police and fire departments and to the operator's home if the low pressure persists more than 60 seconds.

Manual control for the operation of the pumping equipment is provided for emergency use.

The standby engines start automatically if there is a power failure.

The well pumps are operated by float switches in their respective reservoirs.

The high lift pumps are controlled by the water level in the Anne Street reservoir. The pumps are protected from pumping dry by float switches in their respective reservoirs. The system is also used to protect the engine-operated pumps.

Some of the booster pumps operate continuously while others are pressure or flow regulated.

APPENDIX A - (Cont'd)

Distribution System

Water Mains (all C.I.)

SIZE Inches	LENGTH Feet	Miles
4	86,562	16.4
6	190,309	36.1
8	74,349	14.1
10	18,025	3.4
12	22,623	4.3
16	3,696	0.7
TOTAL	395,764	75.0

SERVICES - 6.766

APPENDIX B

CITY OF BARRIE

WATER POLLUTION CONTROL PLANT

PHYSICAL DESCRIPTION

DESIGN DATA

Population	-	30,000
Per Capita Flow	-	100 Gallons
Design Flow	-	3 MGD (average) 6 MGD (maximum) 9 MGD (primary)

PUMPING STATION (at plant)

1 - De Laval single stage 16" centrifugal pump, 3,600 GPM 175' TDH, motivated by a Westinghouse Electric motor, 60 HP

1 - De Laval single stage 12" centrifugal pump, 3,000 GPM, 40' TDH, motiviated by a General Electric motor, 50 HP

1 - De Laval single stage 8" centrifugal pump, 1,200 GPM, 18' TDH, motivated by a Westinghouse Electric motor, 20 HP

INLET SEWER

16" diameter forcemain

PRELIMINARY TREATMENT

1 - Dorr-Oliver - Long, detriter

1 - Chicago Pump Company - comminutor

PRIMARY TREATMENT

PRIMARY SEDIMENTATION

1 - 80'-0" diameter circular tank
Side water depth 10'-0"
Volume 312,000 gallons

Retention at Design - 2.5 hours

Weir Overflow Rate - 12,000 gpd per foot

Surface Settling Rate - 600 gpd per square foot

Sludge Removal - Mechanical sludge scraper and scum collector

SECONDARY TREATMENT

AERATION

4 - rectangular tanks - each 19'-0" x 14'-9"
volume - 967,200 gallons

Retention at 25% return sludge - 6.25 hours

Parallel operation - step aeration

Return sludge to influent channel to aeration tanks

AIR SUPPLY

Diffused air

Blower capacity - 2 @ 1500 cfm
1 @ 2250 cfm

TOTAL 5250 cfm

SECONDARY SEDIMENTATION

2 - rectangular tanks - each 16'-0" x 95'-0" x 11'-0" SWD

Total volume - 428,064 gallons

Retention at design - 3.5 hours

Weir overflow rate - 5850 gpd per foot

Surface settling rate - 490 gpd per square foot

Sludge removal - longitudinal and cross, mechanical sludge collectors

CHLORINE CONTACT

3 - circular tanks

Total volume - 82,368 gallons

Retention at design - 40 minutes

OUTFALL SEWER

30" diameter corrugated iron pipe, 470 feet into Kempenfelt Bay (Lake Simcoe)

DIGESTION

1 - 40' diameter, heated, floating steel cover, 20' side wall depth, primary digester

Total volume - 25,000 cu. ft.

1 - 55' diameter, heated, fixed cover, 24' side wall depth primary digester

Total volume - 55,000 cu. ft.

1 - 55' diameter, unheated 24' side wall depth secondary digester

Total volume - 55,000 cu. ft.

Total capacity - 135,000 cu. ft.

Per capita loading - 4.5 cu. ft.

2 - Heating. Pacific Flush Tank, heat exchanger,
500,000 BTU per hour (large one)
170,000 BTU per hour (old digester)

Supernatant return - to inlet sewer

Gas Production - heating and mixing (only in new primary digester)

PUMPING EQUIPMENT

Raw Sludge

2 - Carter, plunger pumps, 60 gpm, 65' TDH, motivated by Robbins Meyers Electric motors, 3 HP @ 1140 RPM (Note; does not include old plant)

Sludge Return

3 - Weihman Pump Co., centrifugal, 625 US gpm, 23' TDH @ 1150 RPM, motivated by Brook Electric motors, 7.5 HP at 1150 RPM

Sludge Transfer

2 - Weihman Pump Co., centrifugal, 180 US gpm, 35' TDH, motivated by General Electric motors, 5 HP at 1770 RPM

Sludge Recirculation (old plant not included)

1 - Weihman Pump Co. (kept as spare) - see above (Sludge Transfer Pumps)

1 - 4" Wemco centrifugal

CHEMICAL TREATMENT

Chlorination - to four position if necessary

1) Post

2) Pre

3) Supernatant

4) Return Sludge

Fisher and Porter, automatic gas chlorinator,

Capacity - 400 pounds per day

INSTRUMENTATION

1 - 18" Parshall Flume at primary clarifier outfall
Fisher and Porter - % of maximum flow indicator

1 - F & P air flow indicator

2 - F & P waste sludge flow indicators

2 - F & P return sludge flow chart and indicator

1 - transfer sludge meter

1 - gas flow meter

1 - gas pressure meter

BY-PASS ARRANGEMENTS

Flow in excess of 6.0 MGD is by-passed following primary treatment.

APPENDIX C

TABLE 1

CITY OF BARRIE

MUNICIPAL WATER WORKS

WATER CONSUMPTION - M.G.

1969

MONTH	MARY STREET	BAYVIEW PARK	ANNE STREET	PERRY STREET	JOHN STREET	WOOD STREET	TOTAL
January	19.1958	11.7059	12.0117	23.838	7.050	----	73.8014
February	7.9558	20.287	22.2078	14.536	10.060	----	75.0460
March	14.7034	15.5424	12.4662	19.815	11.880	----	74.4070
April	18.1797	17.1275	18.5906	16.764	14.480	----	85.1418
May	18.1432	15.3830	16.9261	15.193	14.340	----	80.0453
June	20.2993	22.5161	16.4441	19.948	21.780	----	100.9870
July	22.4188	23.8633	18.2186	20.382	24.660	.280	109.8227
August	17.6987	26.1333	13.0686	24.211	20.910	.135	102.1566
September	22.2566	25.6114	22.0613	13.766	26.040	----	109.7353
October	15.624	20.0033	5.3826	28.068	15.740	----	84.8179
November	15.0651	18.4386	.0906	36.120	12.430	----	82.1443
December	13.5958	20.6909	8.0849	23.714	15.130	----	81.2156
TOTALS	205.1362	237.3027	165.5531	256.355	194.500	.415	1059.3189

SUMMARY - 1969

TOTAL CONSUMPTION (gals.) 1,059,318,900

AVERAGE DAY (gals.) 2,902,200

APPENDIX C

TABLE 2

CITY OF BARRIE

MUNICIPAL WATER WORKS

WATER CONSUMPTION - M.G.

1970

MONTH	MARY STREET	BAYVIEW PARK	ANNE STREET	PERRY STREET	JOHN STREET	WOOD STREET	TOTAL
January	18.2026	15.0507	19.3691	13.1160	14.1900	3.7900	83.7184
February	26.0311	1.9470	16.8532	19.4750	17.0200	7.8800	89.2063
March	9.5941	16.5453	.0860	32.9080	13.0300	6.2700	78.4334
April	13.3228	13.9694	.0250	21.3940	28.2200	7.5500	84.4812
May	14.3287	11.5130	5.8298	8.8050	34.9700	9.6200	85.0665
June	17.6306	18.9029	19.6854	18.6270	19.8900	14.3300	109.0659
July	15.2533	16.8570	11.4929	22.6050	6.3000	11.4000	83.9082
August	15.5674	16.4872	17.1462	15.7830	15.7400	16.1000	96.8238
September	14.7338	12.5082	11.8063	21.6200	17.1400	14.2700	92.0783
October	14.0045	10.0318	16.5594	11.4440	19.4700	12.7000	84.2097
November	13.5211	12.9580	16.2686	16.8470	21.3900	6.0200	86.0047
December	13.5683	12.5283	12.9963	20.0270	11.8400	9.6700	80.6299
TOTALS	185.7583	159.2988	148.1182	222.6510	219.2000	119.6000	1053.6243

SUMMARY - 1970

TOTAL CONSUMPTION (gals.) 1,053,624,300

AVERAGE DAY (gals.) 2,886,647

APPENDIX C

TABLE 3

STORAGE CALCULATIONS

Population Served - 26,650

Total Storage = A + B + C

where A = 100% of C.U.A. Requirement

B = 25% of maximum day consumption

C = 25% of the sum of "A" and "B"

C.U.A. Requirement = 4,200 GPM for 10 hours
for population
(27,000)

$\therefore$ A = (4,200)(10)(1.0)(60) = 2,520,000 gal.

Maximum day factor for 25,001 - 50,000 is 1.80

Average Demand = 2,886,647 GPD

Maximum Day = (2,886,647)(1.80) GPD

$\therefore$ B = (2,886,647)(1.80)(0.25) = 1,299,000 gal.

C = (A + B)(0.25) = 324,750 gal.

TOTAL STORAGE = 4,143,750 gal.

or approximately 4,144,000 gal.

PUMPAGE CALCULATIONS

Total emergency pumping capacity = 6,400 GPM

Underwriters' fire demand requirement = 4,200 GPM for 10 hours

Maximum day flow (5.2 MIGD) = 3,600 GPM

TOTAL REQUIRED FLOW = 7,800 GPM for 10 hours

APPENDIX C

TABLE 3 - (Cont'd)

(i) For Underwriters' requirements, two major pumps must be considered inoperative at the time of fire flow. Eliminating the John Street and Wood Street wells, this leaves only 4,000 GPM for this system with a resulting storage requirement of

(7,800 - 4,000)(60)(10)	=	2,280,000 gal.
Existing Storage	=	2,693,500 gal.
SURPLUS STORAGE above Underwriters' requirements		413,500 gal.

(ii) Assuming all pumps are operative, storage requirements may be considered to be

(7,800 - 6,400)(60)(10)	=	840,000 gal.
Existing Storage	=	2,693,500 gal.
SURPLUS STORAGE	=	1,853,500 gal.

APPENDIX D

WATER QUALITY CRITERIA FOR PUBLIC GROUND WATER SUPPLIES WITH INDIVIDUAL WELL RESULTS FOR CITY OF BARRIE (1971)

CONSTITUENT OR CHARACTERISTIC	PERMISSIBLE CRITERIA	DESIRABLE CRITERIA	INDIVIDUAL WELL RESULTS					
			Mary Street	Bayview Park	Anne Street	Perry Street	John Street	Wood Street
PHYSICAL								
Colour	75 units	<5 units	20					
Turbidity	Readily removable by defined treatment	Absent	1.5					
Temperature	85°F	Pleasant tasting						
INORGANIC CHEMICALS								
Alkyl benzene sulfonate (ABS)	0.5			0.0				0.0
*Arsenic as As	0.05	Absent		0.00	0.00		0.00	0.00
*Barium as Ba	1.0	Absent		<2.0				
*Cadmium as Cd	0.01	Absent	0.0	0.0	0.0	0.0		
Chloride as Cl	250	<25	7	37	2	2		24
*Chromium as Cr	0.05	Absent	0.00	0.0		0.00		0.00
Copper as Cu	1.0	Virtually absent	0.0	0.0	0.0	0.0		
*Fluoride	2.4	1.0		0.0				0.0
Hardness	Acceptable levels will vary with local hydrogeologic conditions and consumer acceptance		206		198	188		
Hydrogen Sulphide	0.1	Absent						

APPENDIX D - (Cont'd)

CONSTITUENT OR CHARACTERISTIC	PERMISSIBLE CRITERIA	DESIRABLE CRITERIA	INDIVIDUAL WELL RESULTS					
			Mary Street	Bayview Park	Anne Street	Perry Street	John Street	Wood Street
INORGANIC CHEMICALS								
Iron as Fe	0.3	Virtually Absent	0.40	0.10	0.60	0.45		0.60
*Lead as Pb	0.05	Absent	0.0	0.0	0.0	0.0		
Manganese (filterable)	0.05	Absent	0.0			0.01		
Nitrate as NO_3	45.0	Virtually absent		0.78			0.82	0.03
Nickel as Ni			0.0		0.0			
pH range	6.0 - 8.5 units	Least amount of interference with treatment process	7.8		8.0	7.9		7.9
*Selenium as Se	0.01	Absent		0.0	0.0			
*Silver as Ag	0.05	Absent		0.0				
Sulphate as SO_4	250	<50		21				14
Total Dissolved Solids	500	<200		360				360
Zinc as Zn	5	Virtually Absent	0.0	0.0	0.05	0.0		
ORGANIC CHEMICALS								
*Cyanide as HCN	0.20	Absent	<0.01		<0.01	<0.01	<0.01	<0.01
Phenolic Substances	Virtually absent	Absent		25				
MICROBIOLOGICAL								
Pollution Indicator Organisms	Coliform and other pollution indicator organisms should be virtually absent from all ground water supplies.							

* The presence of these substances in excess of the concentrations listed in the above table shall constitute grounds for rejection of the supply. The remaining chemical substances shown above should not be present in a water supply in excess of the listed concentrations where, in the judgement of the OWRC, other more suitable supplies are or can be made available.

APPENDIX E

TABLE 1

CITY OF BARRIE

WATER POLLUTION CONTROL PLANT

1970 FLOWS

MONTH	TOTAL FLOW	MAXIMUM DAY (MGPD)	MINIMUM DAY (MGPD)	AVERAGE DAY (MGPD)
January *	52.7	2.9	1.1	1.7
February *	42.0	1.8	1.2	1.5
March	71.4	3.2	1.6	2.3
April	81.0	3.8	1.0	2.7
May	71.4	3.1	1.1	2.3
June	75.0	3.1	1.8	2.5
July	PLANT UNDER CONSTRUCTION			
August	PLANT UNDER CONSTRUCTION			
September	PLANT UNDER CONSTRUCTION			
October	74.5	2.8	2.1	2.4
November	75.0	2.8	2.3	2.5
December	83.7	3.9	1.4	2.7

* Estimated - meter not working

SUMMARY FOR 1970

**Total Flow	-	626.7 million gallons
Maximum Day	-	3.9 million gallons
Minimum Day	-	1.0 million gallons
Average Day	-	2.3 million gallons

** Note: Total flow does not include the months of July, August and September when plant was under construction.

APPENDIX E

TABLE 2

CITY OF BARRIE

WATER POLLUTION CONTROL PLANT

1971 FLOWS (six months)

MONTH	TOTAL FLOW (MG)	MAXIMUM DAY (MGD)	MINIMUM DAY (MGD)	AVERAGE DAY (MGD)
January	75.6	3.3	1.5	2.4
February	93.8	3.6	2.8	3.3
March	87.7	3.1	2.2	2.7
April	100.2	4.3	2.2	3.3
May	76.8	2.7	1.9	2.4
June	75.5	3.0	1.4	2.5

SUMMARY FOR 1971 (first six months)

Total Flow	-	509.6 MG
Maximum Day	-	4.3 MGD
Minimum Day	-	1.4 MGD
Average Day	-	2.8 MGD

APPENDIX F

TABLE 1

CITY OF BARRIE

WATER POLLUTION CONTROL PLANT

ANALYSIS RESULTS

1970

MONTH	RAW SEWAGE		PRIMARY EFFLUENT	FINAL EFFLUENT	
	BOD	SS	BOD	BOD	SS
January	648	1537	350	14	23
February	588	1010	386	18	47
March	455	1080	330	18	40
April	345	610	205	12	20
May	630	1250	318	10	30
June	425	980	222	8	10
July	PLANT UNDER CONSTRUCTION				
August *	217	256	---	13	46
September	296	475	---	16	20
October	310	386	240	10	24
November	300	254	274	13	26
December	294	290	231	12	18

* No sludge wasted to incoming sewage.

SUMMARY

SOURCE	AVERAGE		% REDUCTION	
	BOD	SS	BOD	SS
Raw Sewage	437	738		
Primary Effluent	284	---	35	
Final Effluent	13	34	97	95

APPENDIX F

TABLE 2

CITY OF BARRIE

WATER POLLUTION CONTROL PLANT

ANALYSIS RESULTS

1971

MONTH	RAW SEWAGE		PRIMARY EFFLUENT		FINAL EFFLUENT	
	BOD	SS	BOD	SS	BOD	SS
January	320	480	210	350	25	39
February	395	665	300	195	18	18
March	354	580	240	190	18	29
April	360	560	210	160	15	21
May	500	600	180	185	15	20
June	460	600	250	240	5	10

SUMMARY

SOURCE	AVERAGE		% REDUCTIONS	
	BOD	SS	BOD	SS
Raw Sewage	398	580		
Primary Effluent	231	220	42	62
Final Effluent	16	22	96	96

APPENDIX F

TABLE 3

CITY OF BARRIE

WATER POLLUTION CONTROL PLANT

SEWAGE STRENGTH

MONTH	T.S.P.S.		M.P.S.		RAW SEWAGE COMBINED	
	BOD	SS	BOD	SS	BOD	SS
1970						
January	245	208	613	2060	648	1537
February	225	208	578	1420	588	1010
March	230	300	470	1300	455	1080
April	215	250	370	875	345	610
May	220	350	400	865	630	1250
June	180	195	445	1400	425	980
July	207	155	-	-	-	-
August	254	200	-	-	217	256
September	302	220	-	-	296	475
October	285	251	251	705	310	386
November	308	210	267	370	300	254
December	195	223	327	650	294	290
AVERAGE	238	230	413	1071	409	738
1971						
January	206	160	275	600	320	480
February	206	165	440	1600	395	665
March	273	240	550	1230	354	580
April	300	310	520	860	360	560
May	350	320	450	970	500	600
AVERAGE	267	239	447	1052	385	577

CITY OF BARRIE

WATER POLLUTION CONTROL PLANT

1971 - 24-HOUR COMPOSITE SAMPLING RESULTS

APPENDIX F

TABLE 4

DATE	FLOW	T.S.P.S.		M.P.S.		COMBINED RAW SEWAGE		PRIMARY EFFLUENT		FINAL EFFLUENT	
		BOD	SS	BOD	SS	BOD	SS	BOD	SS	BOD	SS
	(MGD)	(PPM)	(PPM)	(PPM)	(PPM)	(PPM)/(LB. PER DAY)	(PPM)/(LB. PER DAY)	(PPM)/(LB. PER DAY)	(PPM)/(LB. PER DAY)	(PPM)/(LB. PER DAY)	(PPM)/(LB. PER DAY)
JAN. 12	2.1	156	160	298	810	302/6,342	630/13,230	180/3,780	435/9,135	15/325	38/798
FEB. 3	3.2	206	150	655	1,940	265/8,480	310/9,920	192/6,144	130/4,160	16/512	52/1,664
FEB. 12	3.3					375/12,375	665/21,945	300/9,900	205/6,765	20/660	20/660
MAR. 3	3.6	230	160	370	1,185	380/13,680	480/17,280	295/10,620	160/5,760	14/504	10/360
MAR. 9 - 10	METER OUT	366	395	552	930	345/	565/	232/	185/	18/	9/
JUNE 15	2.6					400/10,400	600/15,600	225/5,850	100/2,600	5/130	14/280
JULY 9	2.8					420/11,760	870/24,360	290/8,120	134/3,752	5/140	10/280
JULY 21	2.2					305/6,710	933/20,526	155/3,410	95/2,090	5/110	10/220
AVERAGE	2.8					349/9,964	631/17,551	234/6,832	168/4,895	12/340	20/609

AVERAGE REMOVAL EFFICIENCY:	BOD	SS
PRIMARY	32%	68%
PLANT	97%	97%

APPENDIX F

TABLE 5

CITY OF BARRIE

WATER POLLUTION CONTROL PLANT

1971 - 24-HOUR COMPOSITE PHOSPHORUS RESULTS

DATE	FLOW (mgd)	COMBINED RAW SEWAGE (ppm)/(Lb. per day)	PRIMARY EFFLUENT (ppm)/(lb. per day)	FINAL EFFLUENT (ppm)/(lb. per day)
May 6	2.6	18/468		8/208
June 15	2.6	12/312	4/104	1.8/47
July 9	2.8	7.5/210	3.2/90	2.0/56
July 21	2.2	5.0/110	0.4/9	0.4/9
AVERAGE	2.5	10.6/275	2.5/67	

APPENDIX G

CITY OF BARRIE

MONTHLY INDUSTRIAL WATER AND SEWAGE CONSUMPTION

NAME	P.U.C. WATER (C.F.)	SEWAGE (C.F.)
Chrysler Canada Outboard Ltd.	50,500	50,000
Canadian Tampax Corporation	12,200	12,200
Robson-Lang Leathers	221,300	425,600
Universal Cooler	148,700	148,700
Lufkin Rule	166,100	57,200
Canadylet Closures	167,300	2,900
Plastomer Ltd.	367,800	291,400
West Bend	144,900	17,500
Hill Refrigation	56,300	56,300
Imperial Eastman	68,700	2,900
Mansfield Rubber	2,459,600	656,100
Kolmar of Canada Ltd.	71,300	71,300
Canadian General Electric	1,749,600	275,100
DeVilbiss Canada Ltd.	67,000	20,800
Lakeview Dairy (unmetered private well)	nil	90,391
Copaco (unmetered private well)	no measurements (est. 16,000)	
Barrie Tanning (unmetered private well)	no measurements (est. 27,300)	
Culligan	97,400	283
Barrie Plating Co.	3,200	3,200
Moldex (unmetered private well)	2,100	2,100

ALL ANALYSIS EXCEPT PH AND TURBIDITY REPORTED IN PPM UNLESS OTHERWISE INDICATED.

CITY OF BARRIE

OUTFALL TABULATION AND ANALYTICAL RESULTS

KEMPENFELDT BAY

APPENDIX H

TABLE I

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS SUSP.	SOLIDS DISS.	OXYGEN SATURATION TEMP. (°C)	DISS. OXYGEN (PPM)	% SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	PHOSPHORUS AS P (PPM) TOTAL	SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	FECAL COLIFORMS	ADDITIONAL ANALYSIS
KB-1	36-INCH CONCRETE STORM	16/8/66	1.2	382	2	380										73,000		
W	SEWER NORTH-WEST OF THE	11/5/71	0.4	360	5	355				<.01	.15	.004	3.8	.006	.002	6	0	
	FOOT OF BAYVIEW DRIVE	7/6/71	0.4	370	5	365				<.01	.08	.008	3.6	.088	<.002	68	20	
		2/7/71	0.4	-	5	-	13.0	9.0		.02	.05	.004	3.5	.006	<.002	1000	28	TURBIDITY : 4
KB-2	24-INCH CONCRETE STORM	16/8/66	1.2	382	2	380										73,000		
W	SEWER JUST NORTH OF THE	11/5/71	0.6	440	5	435				<.01	.15	.004	3.4	.018	.006	200	78	
	CNR STATION	7/6/71	1.6	400	5	395				<.01	.20	.008	3.1	.012	<.002	1,300	1,100	
		2/7/71	0.6	-	5	-	15	8.0		.02	.13	.007	2.3	.028	.016	8,000 +	2,100	TURBIDITY : 2
KB-3	BARRIE WATER POLLUTION	26/10/65	8.4	1,146	25	1,121										0		
T	CONTROL PLANT FINAL	16/8/66	23.0	1,138	30	1,108										>4		
	EFFLUENT TO 30-INCH																	
	OUTFALL 470 FEET INTO																	
	KEMPENFELDT BAY																	
KB-4	36-INCH DIAMETER OUTLET	26/10/65	1.3	318	1	317										330		
D	OF STREAM DRAINING MARSHY	1/11/65	1.5	370	1	369	6	9								46		
	AREA NORTH OF THE	18/8/66	NO	FLOW		NOTED												
	BARRIE WPCP	7/6/71	3.5	380	10	370				1.2	1.9	.009	.01	.26	.15	120	48	

TABLE I (CONT'D)

KEMPENFELDT BAY

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	SOLIDS (PPM) DISS.	OXYGEN SATURATION TEMP. ($^{\circ}C$)	OXYGEN SATURATION DISS. OXYGEN (PPM)	OXYGEN SATURATION % SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITROGEN AS N (PPM) NITRITE	NITROGEN AS N (PPM) NITRATE	PHOSPHORUS AS P (PPM) TOTAL	PHOSPHORUS AS P (PPM) SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	BACTERIOLOGICAL RESULTS FECAL COLIFORMS	ADDITIONAL ANALYSIS
KB-5	18-INCH PIPE FROM	8/6/71	5.0	380	5	375				.22	.42	.064	.40	.018	.001	2,800	1,000	
1	ROBSON LANG	2/7/71	6.5	-	40	-	20.5	0.8		1.4	1.5	.008	.03	.10	<.002	400	74	
	LEATHERS	27/7/71	10.0	-	150	690	40	4.0								100	2	
		29/7/71	2.5	630	20	610	37	4.2		.42	1.3	.011	.09	.06	.002	200	200	
KB-5	4-INCH P.V.C. PIPE	1/11/65	FLOW INSUFFICIENT FOR SAMPLING															
1-2	TO CULVERT AND BAY -	18/8/66	0.3	280	1	279										240		
	ROBSON LANG LEATHERS																	
KB-5	3-INCH COPPER PIPE -	18/8/66	NO FLOW NOTED															
1-3	ROBSON LANG LEATHERS																	
KB-6	SPEEDY BAR CAR WASH	18/8/66	16.0	324	46	278										110,000		
1	SETTLING TANK																	

SAMPLING POINT	DATE SAMPLED	COD	PH	CHLORIDE AS CL	SULPHIDE AS H_2S	TANNINS & LIGNINS	CONDUCTIVITY	CHROMIUM AS CR	ETHER SOLUBLES	MANGANESE AS MG	ZINC AS ZN	COPPER AS CU
KB-5 1	27/7/71	300	9.5	169				2.6	75			
KB-5 1	29/7/71	45	7.9	178	1.0	0	1016	17.5	6	.08	.02	.03

TABLE I (CONT'D)

KEMPENFELDT BAY

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	SOLIDS (PPM) DISS.	OXYGEN SATURATION TEMP. (^{0}C)	OXYGEN SATURATION DISS. OXYGEN (PPM)	OXYGEN SATURATION % SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITROGEN AS N (PPM) NITRITE	NITROGEN AS N (PPM) NITRATE	PHOSPHORUS AS P (PPM) TOTAL	PHOSPHORUS AS P (PPM) SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	BACTERIOLOGICAL RESULTS FECAL COLIFORMS	ADDITIONAL ANALYSIS
KB-6	8-INCH CONCRETE PIPE -	29/10/65	FLOW NOTED - PARTIALLY SUBMERGED															
I-2	EFFLUENT FROM CAR WASH	5/11/65	16.0	448	202	246										6,500		
	SETTLING TANK TO BAY -	18/8/66	64.0	452	218	234										330,000		
	SUBMERGED EFFLUENT PIPE																	
	THEREFORE RECEICING WATER																	
	SAMPLE ONLY																	
KB-6	6-INCH GALVANIZED OVERFLOW	18/8/66	NO FLOW NOTED															
I-3	TO BAY FROM CAR WASH SETTLING																	
	TANK																	
KB-7	18-INCH CONCRETE STORM	29/10/65	NO FLOW NOTED - SCUM AND REFUSE IN AREA															
W	SEWER - JUST SOUTH OF FOOT	5/11/65	NO FLOW NOTED - SCUM AND REFUSE IN AREA															
	OF BAYFIELD STREET	18/8/66	NO FLOW NOTED - SCUM AND REFUSE IN AREA															
KB-8	60-INCH CONCRETE STORM	29/10/65	PARTIALLY SUBMERGED - NO APPARENT FLOW															RECEIVES FLOW -
W	SEWER JUST NORTH OF THE	5/11/65	PARTIALLY SUBMERGED - NO APPARENT FLOW															STREAM E EAST OF
	FOOT OF BAYFIELD STREET	18/8/66	2.3	186	1	187										9,100		BAYFIELD GREENISH
		8/6/71	8.5	500	90	410	11	10.4		.02	2.0	.036	.61	.60	.060	8,000+	8,000 +	DISCOLOURATION
KB-9	36-INCH GALVANIZED IRON	18/8/66	PARTIALLY SUBMERGED - NO APPARENT FLOW															
W	STORM SEWER JUST NORTH	8/6/71	NO FLOW NOTED															
	OF THE FOOT OF MULCASTER																	
	STREET																	

TABLE I - (CONT'D)

KEMPENFELDT BAY

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM)			OXYGEN SATURATION			NITROGEN AS N (PPM)				PHOSPHORUS AS P		BACTERIOLOGICAL RESULTS		ADDITIONAL ANALYSIS
				TOTAL	SUSP.	DISS.	TEMP. (°C)	DISS. OXYGEN (PPM)	% SATURATION	FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	TOTAL	SOLUBLE	TOTAL COLIFORMS	FECAL COLIFORMS	
KB-10 W	36-INCH GALVANIZED IRON STORM SEWER JUST NORTH OF THE FOOT OF MULCASTER STREET	18/8/66	PARTIALLY SUBMERGED - NO APPARENT FLOW															
		8/6/71	NO FLOW NOTED															
KB-11 W	26 X 20-INCH CONCRETE BOX STORM SEWER WEST OF THE FOOT OF ST. VINCENT STREET	18/8/66	FLOW INSUFFICIENT FOR SAMPLING															
		9/6/71	3.0	-	5	-				.02	.34	.002	.35	.024	.002	300	300	
KB-12 W	10-INCH DIAMETER METAL STORM SEWER WEST OF THE FOOT OF RODNEY STREET	18/8/66	FLOW INSUFFICIENT FOR SAMPLING															
		7/6/71	NO FLOW NOTED															
KB-13 W	36-INCH DIAMETER METAL STORM SEWER AT FOOT OF RODNEY STREET	29/10/65	FLOW NOTED															
		6/11/65	0.9	455	1	454										10		
		18/8/66														300		
		8/6/71	0.4	300	5	295				.01	.17	.011	.21	.026	.008	0	0	
KB-14 W	18-INCH DIAMETER METAL STORM SEWER FOOT OF COOK STREET	29/10/65	FLOW NOTED															
		5/11/65	0.8	890	2	888										600		
		18/8/66	NO FLOW NOTED															
		7/6/71	INSUFFICIENT FLOW FOR SAMPLING															

TABLE I - (CONT'D)

KEMPENFELDT BAY

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	SOLIDS (PPM) DISS.	OXYGEN SATURATION TEMP. (°C)	OXYGEN SATURATION DISS. OXYGEN (PPM)	OXYGEN SATURATION % SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITROGEN AS N (PPM) NITRITE	NITROGEN AS N (PPM) NITRATE	PHOSPHORUS AS P TOTAL	PHOSPHORUS AS P SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	BACTERIOLOGICAL RESULTS FECAL COLIFORMS	ADDITIONAL ANALYSIS
KB-15 W	15-INCH DIAMETER METAL STORM SEWER EAST OF THE FOOT OF VANCOUVER STREET	5/11/65	FLOW INSUFFICIENT FOR SAMPLING															
		18/8/66	NO FLOW NOTED															
		7/6/71	FLOW INSUFFICIENT FOR SAMPLING															
KB-16 W	48-INCH DIAMETER METAL STORM SEWER FOOT OF PUGET STREET	18/8/66	FLOW INSUFFICIENT FOR SAMPLING															
		7/6/71	FLOW INSUFFICIENT FOR SAMPLING															
KB-17 W	18-INCH METAL STORM SEWER WEST OF FOOT OF JOHNSON STREET	18/8/66	NO FLOW NOTED															
		7/6/71	NO FLOW NOTED															
KB-18 W	24-INCH DIAMETER METAL STORM SEWER NORTH OF GOWAN STREET, EAST OF CNR TO KEMPENFELDT BAY	19/5/71	1.0	320	5	315				<.01	.55	.012	3.2	.056	.006			

CITY OF BARRIE

OUTFALL TABULATION AND ANALYTICAL RESULTS

DITCHES TO STREAMS

APPENDIX H

TABLE 2

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	SOLIDS (PPM) DISS.	OXYGEN SATURATION TEMP. (°C)	OXYGEN SATURATION DISS. OXYGEN (PPM)	OXYGEN SATURATION % SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITROGEN AS N (PPM) NITRITE	NITROGEN AS N (PPM) NITRATE	PHOSPHORUS AS P TOTAL	PHOSPHORUS AS P SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	BACTERIOLOGICAL RESULTS FECAL COLIFORMS	ADDITIONAL ANALYSIS
D-B-1	DITCH ALONG NORTH SIDE OF DUNLOP STREET IN FRONT OF BRITISH PEACOCK PETROLEUM, EMPTYING INTO STREAM B AT FERNDALE ROAD	11/5/71	42.0	960	70	890				1.4	7.0	.012	.02	.48	.002	10	0	
D-C-2	DRAINAGE AREA BEHIND D. MORAN CONSTRUCTION NEAR SC-0.57 CONTAINING OILY WASTES TO STREAM C	12/5/71	THE DARK BROWN VISCOUS OIL EXTRACTED FROM THE SAMPLE WAS EXAMINED BY INFRARED SPECTROSCOPY. THE SPECTRUM OBTAINED WAS FOUND TO BE CHARACTERISTIC OF A USED OR AGING PARAFFINIC BASE PETROLEUM LUBRICATING OIL.															EVIDENCE OF OIL WASTES, BEING DUMPED INTO AND NEAR STREAM.
D-B-2	DRAINAGE AREA JUST DOWNSTREAM OF SB-0.64 BEHIND SIMCOE PETROLEUM (TEXACO) NEAR ANNE AND JOHN STREET	27/7/71	FUEL OIL TYPE - OILY MATERIAL (70 PPM) WAS IDENTIFIED BY IR AS A HIGH BOILING PETROLEUM FRACTION - POSSIBLY SIMILAR TO A LABORATORY OIL OR PARAFFIN OIL (NUGEL OR LUBE OIL). THE MATERIAL WAS NOT VOLATILE ENOUGH FOR GAS CHROMATOGRAPHY.															

CITY OF BARRIE

OUTFALL TABULATION AND ANALYTICAL RESULTS

STREAM A

APPENDIX H

TABLE 3

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	SOLIDS (PPM) DISS.	OXYGEN SATURATION TEMP. (^{0}C)	OXYGEN SATURATION DISS. OXYGEN (PPM)	OXYGEN SATURATION % SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITROGEN AS N (PPM) NITRITE	NITROGEN AS N (PPM) NITRATE	PHOSPHORUS AS P TOTAL	PHOSPHORUS AS P SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	BACTERIOLOGICAL RESULTS FECAL COLIFORMS	ADDITIONAL ANALYSIS
SA-0.00	STREAM 'A' - 48-INCH	26/10/65	3.8	430	4	426	8	9	75							9,000		
	DIAMETER TWIN OUTLETS	27/10/65	23.0	448	20	428	9	9	77							16,000		
	TO KEMPENFELDT BAY	16/8/66	2.8	470	9	461	18	7.5	77							72,000		
		11/5/71					11	3.1	28							1,900	1,000	ETHER SOLUBLES : 9
		8/6/71	2.5	520	10	510	15	8.1	78	.15	.50	.033	.65	.082	.049	4,000	2,100	PHENOLS : 4 PPB
		2/7/71	4.0	-	10	-				.03	.66	.022	.67	.072	.004	8,000 +	400	TURBIDITY : 2
SA-0.09 W	12-INCH DIAMETER STORM	27/10/65	FLOW INSUFFICIENT FOR SAMPLING															
	SEWER - EAST OF BRADFORD	16/8/66	FLOW INSUFFICIENT FOR SAMPLING															
	STREET	11/5/71	NO FLOW															
SA-0.19 P	4-INCH DIAMETER CAST	27/10/65	NO FLOW (EVIDENCE OF PREVIOUS DISCHARGE OF PAINT WASTES)															
	IRON OUTLET - DANGERFIELD	16/8/66	NO FLOW															
	MOTORS	11/5/71	NO FLOW															
SA-0.19 P-2	12-INCH DIAMETER OUTLET	27/10/66	FLOW INSUFFICIENT FOR SAMPLING (EVIDENCE OF PREVIOUS DISCHARGE OF OILY WASTES)															
	- DANGERFIELD MOTORS	16/8/66	NO FLOW															
		11/5/71	18.0	900	330	570				<.01	1.7	.021	2.5	.45	.021	200	10	ABS : 0.8

TABLE 3 - (CONT'D)

STREAM A

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	SOLIDS (PPM) DISS.	OXYGEN SATURATION TEMP. (°C)	OXYGEN SATURATION DISS. OXYGEN (PPM)	OXYGEN SATURATION % SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITROGEN AS N (PPM) NITRITE	NITROGEN AS N (PPM) NITRATE	PHOSPHORUS AS P TOTAL	PHOSPHORUS AS P SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	BACTERIOLOGICAL RESULTS FECAL COLIFORMS	ADDITIONAL ANALYSIS
SA-0.37	STREAM 'A' - EAST OF	27/10/65	17.0	462	64	398										600		
	INNISFIL STREET	10/5/71	1.0	560	15	545	20		28	.02	.54	.014	1.0	.08	.012	38	30	
		9/6/71	1.0	-	5	-	15	9.8		.08	.22	.020	.60	.10	.024	400	400	
SA-0.37	STORM SEWER -		UNDER ROAD INACCESSIBLE															
W	INNISFIL STREET																	
SA-0.37	STORM SEWER -		UNDER ROAD INACCESSIBLE															
W-2	INNISFIL STREET																	
SA-0.39	6-INCH DIAMETER STORM		INACCESSIBLE															
W	SEWER EAST OF RAY'S																	
	SIMCOE MOTORS LTD.																	
SA-0.57	STREAM 'A' EAST OF	27/10/65	5.2	556	74	482										13,000		
	ANNE STREET	10/5/71	0.6	420	5	415				.02	.36	.014	.61	.032	.008	500	200	
		9/6/71	0.8	-	5	-	12.5	9.6		.09	.41	.016	.42	.038	.009	1,200	600	
SA-0.57	STORM SEWER -		UNDER ROAD INACCESSIBLE															
W	ANNE STREET																	
SA-0.74	STREAM 'A' - NORTH OF TIFFIN	27/10/65	8.0	552	50	482	7	11								4,800		
	STREET AND UPSTREAM FROM	16/8/66	2.0	368	14	354										420		
	TUCKER'S	9/6/71	0.6	-	5	-	12.5	9.4		.08	.44	.018	.44	.044	.013	1,500	1,100	

TABLE 3 - (CONT'D)

STREAM A

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SUSP.	DISS.	OXYGEN SATURATION TEMP. (°C)	DISS. OXYGEN (PPM)	% SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	PHOSPHORUS AS P TOTAL	SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	FECAL COLIFORMS	ADDITIONAL ANALYSIS
SA-0.74 W	STORM SEWER - TIFFIN STREET		UNDER ROAD	INACCESSIBLE														
SA-0.75	STREAM 'A' - SOUTH OF TIFFIN STREET	27/10/65	4.4	428	30	398										2,500		
		10/5/71	0.8	380	5	375				.04	.32	.014	.44	.036	.006	300	30	
		9/6/71	1.0	-	10	-	13	9.0		.07	.20	.068	.43	.044	.016	2,100	1,800	
SA-0.75 I	8-INCH DIAMETER CLAY OUTFALL TO STREAM 'A' - J. MURRAY PRATT MFG. CO.	9/6/71	0.4	-	5	-				.01	.20	.001	<.01	.042	.010	0	0	
SA-0.76	STREAM 'A' - SOUTH OF CNR TRACKS	27/10/65	4.2	402	5	397										2,700		
		10/5/71	0.8	400	5	405				.01	.30	.066	.33	.040	.012	1,100	200	
		9/6/71	0.6	-	10	-	13.5	9.6		.05	.20	.40	.40	.052	.009	900	100	
SA-0.76 W	24-INCH DIAMETER STORM SEWER WEST OF ALFRED STREET	27/10/65	NO	FLOW														
		10/5/71	1.0	540	5	535				<.01	.10	.012	4.9	.050	.037	400	200	
		9/6/71	NO	FLOW														
SA-0.85	STREAM 'A' - NORTH OF WOOD STREET	27/10/65	2.1	400	10	390										570		
SA-0.85 I	DE VILBISS OUTLET TO CULVERT - WOOD STREET			INACCESSIBLE														

TABLE 3 - (CONT'D)

STREAM A

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SUSP.	DISS.	OXYGEN SATURATION TEMP. (^{o}C)	DISS. OXYGEN (PPM)	% SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	PHOSPHORUS AS P TOTAL	SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	FECAL COLIFORMS	ADDITIONAL ANALYSIS
SA-0.86 W	STORM SEWER TO CULVERT @ WOOD STREET		INACCESSIBLE															
SA-0.86 R	SEWAGE PUMPING STATION RELIEF SEWER SOUTH OF WOOD STREET	27/10/65	NO	FLOW														
		16/8/66	NO	FLOW														
		10/5/71	NO	FLOW														
SA-0.95	STREAM 'A' - FOOT OF CAMPBELL AVENUE	27/10/65	2.4	390	14	376										900		
		9/6/71	0.8	-	5	-	14	9.9		.02	.48	.02	.35	.076	.017	1,300	300	
SA-1.13	STREAM 'A' - WEST OF HWY. 400	27/10/65																
SA-1.13 I	DITCH FROM UNIVERSAL COOLER - WEST OF HWY. 400																	
SA-1.50	STREAM 'A' - SOUTH OF PATTERSON ROAD	16/8/66	1.8	366	6	360										36,000		
		11/5/71	0.8	340	20	320	19		33	<.01	.50	.009	.48	.088	.031	400	300	
		9/6/71	1.2	-	5	-	14	10		.02	.64	.003	<.01	.11	.032	3,800	1,900	

CITY OF BARRIE

OUTFALL TABULATION AND ANALYTICAL RESULTS

STREAM B

APPENDIX H

TABLE 4

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SUSP.	DISS.	OXYGEN SATURATION TEMP. (°C)	DISS. OXYGEN (PPM)	% SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	PHOSPHORUS AS P TOTAL	SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	FECAL COLIFORMS	ADDITIONAL ANALYSIS
SB-0.00	STREAM B AT 36-INCH	1/11/65	15.0	748	29	719	11	8								3,200		
	DIAMETER OUTLET TO	16/8/66	7.2	562	40	522	24	4								200		
	KEMPENFELDT BAY	10/5/71	1.2	360	10	350	21		24	.57	1.2	.086	.27	.13	.034	300	30	
		12/5/71	2.5	600	10	590	15		17	.65	1.5	.18	.26	.14	.014	18,000	100	
		8/6/71	3.5	620	10	610	18	5.2		.95	1.5	.22	.42	.092	.007	500	500	
		2/7/71	3.0	-	5	-	21	6.2		.43	.72	.027	.23	.056	<.002	1,000	200	TURBIDITY : 6
SB-0.28	STREAM B - WEST OF	1/11/65	13.0	582	31	551										4,600		OIL
	BRADFORD STREET	16/8/66	13.0	224	32	192										9,000		
		12/5/71	3.5	420	10	410				.73	1.4	.16	.26	.13	.02	800	80	REFUSE AND COLLECTION
		10/6/71	3.0	1,400	5	1,395	21.5	6.8		.94	1.3	.184	.41	.13	.018	2,100	300	OF OIL RESIDUE
		29/6/71	1.2	-	10	-	22	3.8		.74	1.8	.096	.27	.11	.022	1,400	300	TURBIDITY : 6
		27/7/71	3.5	410	5	405	17.5	7.4		.32	.82	.009	.23	.20	.088	80 +	80 +	

DATE SAMPLED	COPPER AS CU	ZINC AS ZN	ETHER SOLUBLES	PH
27/7/71	0.0	0.02	2	7.7

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SUSP.	DISS.	TEMP. (°C)	DISS. OXYGEN (PPM)	% SATURATION	FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	PHOSPHORUS TOTAL	SOLUBLE	TOTAL COLIFORMS	FECAL COLIFORMS	ADDITIONAL ANALYSIS
SB-0.40	STREAM B - WEST OF INNISFIL STREET	29/6/71	0.6	-	20	-	22	5.9		.78	1.3	.094	.29	.088	.012	700	200	GASSY APPEARANCE TURBIDITY : 6

TABLE 4 - (CONT'D)

STREAM B

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SUSP.	DISS.	OXYGEN SATURATION TEMP. (°C)	DISS. OXYGEN (PPM)	% SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	PHOSPHORUS AS P TOTAL	SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	FECAL COLIFORMS	ADDITIONAL ANALYSIS
SB-0.40 W	12-INCH DIAMETER STORM SEWER EAST OF INNISFIL STREET	5/11/65	NO FLOW NOTED															
		16/8/66	NO FLOW NOTED															
		12/5/71	NO FLOW NOTED															
SB-0.40 P	6-INCH DIAMETER ASBESTOS OUTLET EAST OF INNISFIL STREET	5/11/65	NO FLOW NOTED															
		16/8/66	NO FLOW NOTED															
		12/5/71	NO FLOW NOTED															
SB-0.41 I	12-INCH DIAMETER CONCRETE OUTLET FROM LUFKIN RULE OF CANADA - WEST OF INNISFIL STREET	5/11/65	40.0	364	27	337										0		CYANIDE 0; IRON 9.6
		16/8/66	14.0	460	48	412												
		12/5/71	NOT LOCATED															
		10/6/71	5.0	320	10	310	14.5	8.1		.80	1.3	.011	.06	.070	.004	2,800	2,000	6.2

DATE SAMPLED	PH AT LAB	CHROMIUM AS CR TOTAL	HEXAVALENT	ZINC AS ZN	NICKEL AS NI	COPPER AS CU	CYANIDE AS HCN	IRON AS FE
16/8/66	7.3	30	26	6.9	5.5	4.4	1.7	18.5

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SUSP.	DISS.	OXYGEN SATURATION TEMP. (°C)	DISS. OXYGEN (PPM)	% SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	PHOSPHORUS AS P TOTAL	SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	FECAL COLIFORMS	ADDITIONAL ANALYSIS
SB-0.64	STREAM B - EAST OF ANNE STREET BELOW INDUSTRIAL WASTE OUTFALL FROM JOHN STREET	1/11/65	3.0	802	9	703										900		CYANIDE AS HCN 0; OIL
		16/8/66	1.4	378	4	374										160		1.1; INDUSTRIAL WASTE ODOUR
		12/5/71	3.0	360	5	355				.76	1.3	.20	.19	.23	.11	60	4	OILY APPEARANCE
		10/6/71	1.0	300	5	295	19	8.6		.09	.34	.180	.28	.064	.012	1,200	1,200	
		29/6/71	0.4	-	55	-	26.5	6.8		.26	.45	.11	.25	.070	.026	168	100	TURBIDITY : 8

TABLE 4 - (CONT'D)

STREAM B

SAMPLING POING	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SUSP.	DISS.	OXYGEN SATURATION TEMP. (°C)	DISS. OXYGEN (PPM)	% SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	PHOSPHORUS AS P TOTAL	SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	FECAL COLIFORMS	ADDITIONAL ANALYSIS
SB-0.64	STREAM B - EAST OF ANNE	27/7/71	0.8	390	10	380	15	7.0		.04	.56	.008	.18	.23	.030	1,000	300	
	STREET BELOW INDUSTRIAL																	
	WASTE OUTFALL FROM		COPPER AS CU		ZINC AS ZN		ETHER SOLUBLES											
	JOHN STREET	27/7/71	0.0		0.0		<2											
SB-0.64	STORM SEWER RECEIVES	1/11/65																
W	INDUSTRIAL WASTES FROM	16/8/66	UNDER ROAD		INACCESSIBLE													
	AREA TO THE WEST ON	12/5/71																
	JOHN STREET																	
SB-0.79	STREAM B SOUTH OF	1/11/65	4.0	402	1	401										1,260		
	VICTORIA STREET	16/8/66	0.5	256	1	255										410		
		12/5/71	4.0	500	15	485				.21	1.3	.015	.015	.07	.002	600	60	
		10/6/71	3.0	-	10	-	16.5	10.5		.68	1.4	.042	.17	.084	<.001	7,600	300	
		29/6/71	5.0	-	5	-	27.5	8.8		.27	.88	.65	.55	.048	.014	200	200	
		27/7/71	0.6	480	5	475	18.5	11.0		.02	.53	.033	.41	.014	.002	80 +	36	
			COPPER AS CU		ZINC AS ZN		ETHER SOLUBLES											
		27/7/71	0.0		0.0		0											
SB-1.28	STREAM B JUST WEST	10/6/71	4.0	-	15	-	13	6.2		.83	1.7	.022	.14	.10	.001	200	200	
	OF HWY. 400	29/6/71	3.0	-	0	-	24	3.6		1.4	2.2	.008	.012	.056	.004	400	300	LFS ODOUR
SBTC-1.31	TRIBUTARY C OF STREAM B	13/5/71	4.0	410	5	405				.036	.006	.02	.80	.006	<.01	0	0	
	JUST WEST OF HWY. 400																	

TABLE 4 – (CONT'D)

STREAM B

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	SOLIDS (PPM) DISS.	OXYGEN SATURATION TEMP. (°C)	OXYGEN SATURATION DISS. OXYGEN (PPM)	OXYGEN SATURATION % SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITROGEN AS N (PPM) NITRITE	NITROGEN AS N (PPM) NITRATE	PHOSPHORUS AS P TOTAL	PHOSPHORUS AS P SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	BACTERIOLOGICAL RESULTS FECAL COLIFORMS	ADDITIONAL ANALYSIS
SB-1.84	STREAM B JUST EAST	11/5/71	12.0	460	10	450	16.5		15	.43	1.5	.017	.14	.052	.004	500	52	
	OF FERNDALE ROAD	13/5/71	5.0	460	10	450	16		11	.35	1.9	.023	.59	.050	<.001	260	130	CHLORIDE AS CL 48
		10/6/71	14.0	-	30	-	12	5.9		.71	2.5	.018	.24	.15	.002	200	100	
SBTB-2.01	TRIBUTARY B OF STREAM B JUST SOUTH OF DUNLOP STREET WEST	13/5/71	0.6	400	20	380				.02	.64	.007	1.4	.026	.002	500	200	CL : 39
SBTB-2.09	TRIBUTARY B OF STREAM	13/5/71	0.4	380	10	370				<.01	.54	.006	1.5	.028	.003	300	80	
	B WEST OF FERNDALE AND NORTH OF DUNLOP STREET	10/6/71	2.0	-	20	-	13.5	10		<.01	0.45	.005	1.7	.020	.002	100	80	
SB-2.11	STREAM B JUST WEST OF	11/5/71	24.0	520	15	505				1.4	2.2	.007	<1	.036	.008	90	30	
	DUNLOP STREET APPROX.	13/5/71	44.0	480	15	465	13.5		10	1.4	2.2	.016	.05	.020	.003	70	32	CL : 42
	1 MILE DOWNSTREAM OF LANDFILL SITE	10/6/71					10	5								400	120	
SB-2.67	STREAM B – WEST SIDE OF	13/5/71	130.0	560	20	540	10		25	1.7	2.8	.015	.78	.045	.001	52	38	
	EDGEHILL DRIVE APPROX. ½	18/5/71	120.0	185	25	460				2.0	2.8	.014	.78	.050	.001	80	30	IRON AS FE : 6.4
	MILE DOWNSTREAM OF	9/6/71	130.0	520	30	490	14	8.8		1.9	[illegible]	.011	.47	.060	.001	90	24	
	LAND FILL SITE		FOR ADDITIONAL ANALYSIS SEE TABLE															
		28/7/71					11	9.7								300	200	

TABLE 4 - (CONT'D)

STREAM B

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SUSP.	DISS.	OXYGEN SATURATION TEMP. (°C)	DISS. OXYGEN (PPM)	% SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	PHOSPHORUS AS P TOTAL	SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	FECAL COLIFORMS	ADDITIONAL ANALYSIS
SBTA-3.00	TRIBUTARY A OF STREAM B JUST UPSTREAM OF JUNCTION WITH STREAM B	18/5/71	0.6	280	20	260				.02	.52	.002	1.0	.032	.002	10	10	IRON AS FE : 0.10
SBTA-3.16	TRIBUTARY A OF STREAM B AT APPARENT SOURCE, SOUTH-WEST OF ROAD FROM EDGEHILL TO LFS AND SOUTH-EAST OF SB-3.30	13/5/71	0.6	400	60	340	8		22	<.01	1.2	.002	1.1	.082	.004	10	0	
SB-3.00	STREAM B JUST UPSTREAM OF JUNCTION WITH TRIBUTARY A	18/5/71	200	610	40	570				2.8	3.9	.015	.76	.050	.001	60	10	IRON AS FE: 11.0
SB-3.30	STREAM B AT APPARENT SOURCE JUST SOUTH-EAST OF ENTRANCE TO LANDFILL SITE	13/5/71														0	0	

CITY OF BARRIE

OUTFALL TABULATION AND ANALYTICAL RESULTS

STREAM C

APPENDIX H

TABLE 5

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	SOLIDS (PPM) DISS.	OXYGEN SATURATION TEMP. (^{o}C)	OXYGEN SATURATION DISS. OXYGEN (PPM)	OXYGEN SATURATION % SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITROGEN AS N (PPM) NITRITE	NITROGEN AS N (PPM) NITRATE	PHOSPHORUS AS P TOTAL	PHOSPHORUS AS P SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	BACTERIOLOGICAL RESULTS FECAL COLIFORMS	ADDITIONAL ANALYSIS
SC-0.00	STREAM C AT 48-INCH	1/11/65	8.0	360	14	346	6	6								460,000		
	DIAMETER OUTLET TO	16/8/66	3.6	394	1	393	18	4								50,000		
	KEMPENFELDT BAY	8/6/71	4.0	380	10	370	17	3		1.1	1.3	.04	.32	.15	.042	8,000 +	8,000 +	PHENOLS : 4 PPB
		2/7/71	1.2	-	5	-	19.5	6.3		1.0	1.2	.028	.36	.056	.014	1,900	200	TURBIDITY : 3
SC-0.19	STREAM C - EAST OF	1/11/65	23.0	546	212	334										600,000		RAW SEWAGE
	BRADFORD STREET	17/8/66	3.4	390	9	381										20,000		RAW SEWAGE
		14/5/71	1.2	420	10	410				.95	1.0	.025	.73	-	.35	1,500	500	TURBIDITY : 10
		2/7/71	1.2	-	15	-	19	8.3		.95	1.3	.032	.45	.044	<.002	1,200	100	
SC-0.19 W	STORM SEWER - AT BRADFORD STREET WEST		UNDER ROAD INACCESSIBLE															
SC-0.20	STREAM C - WEST OF	1/11/65	40.0	474	150	324										90,000		
	BRADFORD STREET	17/8/66	2.0	374	9	365										1,170		
		14/5/71	5.0	420	10	410				1.1	2.0	.018	.78	0.60	.34	3,900	1,100	
		2/7/71	1.2	-	15	-	19	8.2		.96	1.3	.030	.45	.042	<.002	1,700	100	

TABLE 5 - (CONT'D)

STREAM C

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	SOLIDS (PPM) DISS.	OXYGEN SATURATION TEMP. (^{o}C)	OXYGEN SATURATION DISS. OXYGEN (PPM)	OXYGEN SATURATION % SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITROGEN AS N (PPM) NITRITE	NITROGEN AS N (PPM) NITRATE	PHOSPHORUS AS P TOTAL	PHOSPHORUS AS P SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	BACTERIOLOGICAL RESULTS FECAL COLIFORMS	ADDITIONAL ANALYSIS
SC-0.20 W	12-INCH DIAMETER SEWER WEST OF BRADFORD STREET NORTH SIDE OF STREAM	1/11/65	14.0	320	204	116										6,700		
		17/8/66	FLOW INSUFFICIENT FOR SAMPLING															
		14/5/71	FLOW INSUFFICIENT FOR SAMPLING															
SC-0.20 P	8-INCH DIAMETER OUTLET WEST OF BRADFORD STREET SOUTH SIDE OF STREAM		NO APPARENT FLOW															
SC-0.21 P	8-INCH DIAMETER OUTLET WEST OF BRADFORD STREET SOUTH SIDE OF STREAM		NO APPARENT FLOW															
SC-0.22 I	10-INCH GALVANIZED IRON OUTLET - BESIDE GENERAL ELECTRIC AND EAST OF THE FOOT BRIDGE		NO APPARENT FLOW															
SC-0.22 I-2	10-INCH GALVANIZED IRON OUTLET - BESIDE GENERAL ELECTRIC AND EAST OF THE FOOT BRIDGE		NO APPARENT FLOW															

TABLE 5 - (CONT'D)

STREAM C

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	SOLIDS (PPM) DISS.	OXYGEN SATURATION TEMP. (°C)	OXYGEN SATURATION DISS. OXYGEN (PPM)	OXYGEN SATURATION % SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITROGEN AS N (PPM) NITRITE	NITROGEN AS N (PPM) NITRATE	PHOSPHORUS AS P TOTAL	PHOSPHORUS AS P SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	BACTERIOLOGICAL RESULTS FECAL COLIFORMS	ADDITIONAL ANALYSIS
SC-0.23	WOODEN BOX OUTLET	14/5/71	1.2	300	5	295	14.5		24	.24	.63	.015	.13	.095	.062	300	4	
I	BESIDE GENERAL ELECTRIC	2/7/71	1.0	320	10	-	14	8.2		.16	.18	.007	.04	.020	<.002	200	24	TURBIDITY : 12
	AND EAST OF THE FOOT BRIDGE																	
SC-0.23	DRAINAGE AREA BESIDE	1/11/65	BUNKER 'C' OIL TO STREAM															
D	OIL STORAGE AREA FOR	17/8/66	NO DRAINAGE NOTED															
	GENERAL ELECTRIC - WEST	14/5/71	NO DRAINAGE NOTED															
	OF THE FOOT BRIDGE																	
SC-0.24	WOODEN BOX OUTLET	14/5/71	1.4	320	10	310	17		17.5	.11	.58	.012	.14	.084	-	200	56	
I	BESIDE GENERAL	2/7/71	2.0	480	15	-	17.5	4.8		.46	1.5	.024	.34	.052	<.002	200	200	TURBIDITY : 6
	ELECTRIC AND WEST OF THE FOOT BRIDGE - SUBMERGED OUTLET - IMMEDIATE RECEIVING WATER																	
SC-0.26	WOODEN BOX OUTLET	1/11/65	3.8	254	6	248										100		
W	BESIDE GENERAL ELECTRIC	14/5/71	4.0	400	35	365	14		22	.03	1.3	.009	.03	12.0	11.0	7,800	800	
	AND WEST OF FOOT BRIDGE	2/7/71	0.8	340	5	-	13	8.5		.10	.15	.005	.03	.042	.006	52	0	TURBIDITY : 12
	- SUBMERGED OUTLET - IMMEDIATE RECEIVING WATER																	

TABLE 5 - (CONT'D)

STREAM C

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SUSP.	DISS.	OXYGEN SATURATION TEMP. (^{o}C)	DISS. OXYGEN (PPM)	% SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	PHOSPHORUS AS P TOTAL	SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	FECAL COLIFORMS	ADDITIONAL ANALYSIS
SC-0.27	STREAM C EAST OF INNISFIL STREET	1/11/65	4.0	368	25	343										5,200		
		17/8/66	1.1	422	5	417										16,000		
		14/5/71	7.5	440	10	430	10.5	24.5		1.4	2.4	.025	1.0	.042	.001	3,000	800	
		2/7/71	5.0	-	15	-	18	7.2		1.5	1.6	.044	.60	.048	<.002	2,100	100	TURBIDITY : 12
SC-0.27 W	STORM SEWER ON INNISFIL STREET WEST OF VESPRA STREET		UNDER ROAD INACCESSIBLE															
SCTA-0.30	TRIBUTARY A OF STREAM C WEST OF PERRY STREET	1/11/65	4.4	380	25	355										2,100		
		14/5/71	1.6	380	10	370	10	24		.01	.54	.002	1.8	.030	<.001	240	230	
SCTA-0.30 R	SEWAGE PUMPING STATION RELIEF SEWER - SOUTH OF PERRY STREET		N O F L O W N O T E D															
SCTA-0.44	TRIBUTARY A OF STREAM C - NORTH OF DUNLOP STREET	14/5/71	1.6	380	5	375	8		100	.01	.27	.001	1.7	.014	.002			
SCTA-0.83	TRIBUTARY A OF STREAM C JUST BELOW PLAZA	2/11/65	1.2	294	1	293										290		
		17/8/66	0.5	316	5	311										520		
		30/6/71	0.8	-	15	-	16.5	8.1		.01	.64	.004	1.2	.052	<.001	2,000	1,500	TURBIDITY : 10

TABLE 5 - (CONT'D)

STREAM C

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	SOLIDS (PPM) DISS.	OXYGEN SATURATION TEMP. (°C)	OXYGEN SATURATION DISS. OXYGEN (PPM)	OXYGEN SATURATION % SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITROGEN AS N (PPM) NITRITE	NITROGEN AS N (PPM) NITRATE	PHOSPHORUS AS P TOTAL	PHOSPHORUS AS P SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	BACTERIOLOGICAL RESULTS FECAL COLIFORMS	ADDITIONAL ANALYSIS
SCTB-0.57	24-INCH DIAMETER CONCRETE	1/11/65	FLOW	NOTED														
W-2	STORM SEWER SOUTH OF	17/8/66	0.5	506	1	505										1,110		
	DUNLOP STREET DRAINING																	
	EAST TO STREAM																	
SCTB-0.73	INTERMITTENT WATERCOURSE	2/11/65	1.2	688	35	653										570		
	TO TRIBUTARY B OF STREAM	17/8/66	FLOW	INSUFFICIENT			FOR		SAMPLING									
	C JUST NORTH OF DUNLOP	14/5/71														200	72	
	STREET																	
SC-0.57	18-INCH DIAMETER CONCRETE	1/11/65	12.0	608	190	418										4,300		
W	STORM SEWER - NORTH OF	17/8/66	0.6	810	2	808										80		
	VESPRA STREET ON BOYS	12/5/71	1.8	540	5	535				2.0	2.3	.016	.62	.034	.006	80	0	
	STREET (UNIMPROVED)	14/5/71	10	460	5	455	16.5		24	1.8	2.0	.039	.58	.020	.004	0	0	
		2/7/71	4.0	-	5	-	13	7.7		1.6	1.7	.019	.59	.020	.005	160	10	
SC-0.57	STREAM C JUST WEST OF	1/11/65	2.4	170	10	160										3,700		
	BOYS STREET (UNIMPROVED)	12/5/71	2.5	380	10	370				.57	1.2	.016	.85	.036	.002	2,400	300	
		14/5/71	3.0	360	10	350	10		27	.56	1.2	.014	.94	.050	.001	800	400	
		2/7/71	1.8	-	10	-	17	8.0		.28	.36	.060	.69	.048	.007	3,600	100	

TABLE 5 - (CONT'D)

STREAM C

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SUSP.	DISS.	OXYGEN SATURATION TEMP. (°C)	DISS. OXYGEN (PPM)	% SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	PHOSPHORUS AS P TOTAL	SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	FECAL COLIFORMS	ADDITIONAL ANALYSIS
SC-0.74	STREAM C JUST EAST OF ANNE STREET	1/11/65	3.0	356	21	335										3,600		
		12/5/71	1.4	360	15	345				<.01	.41	.013	.85	.038	.002	500	500	
		10/6/71	4.5	330	10	320	19	9.2		.03	.32	.013	.77	.060	.012	600	500	
		30/6/71	0.6	-	5	-	22.5	8.3		1.5	1.6					5,600	2,300	TURBIDITY : 12
SC-0.76 W	STORM SEWER OUTLET ANNE STREET AT PERRY STREET (UNIMPROVED)		UNDER ROAD INACCESSIBLE															NOV. 1/65 - CAR WASH DISCHARGE
SC-0.79	STREAM C JUST WEST OF ANNE STREET	1/11/65	2.0	372	20	352										1,900		
		17/8/66	0.9	336	1	335										1,140		
		12/5/71	1.0	420	120	300	10		25	.01	.74	.011	.87	.084	.007	800	200	
		10/6/71	1.4	-	5	-	13	9.6		<.01	0.36	.016	.76	.064	.006	500	500	
		28/7/71	1.6	-	5	-										1,300	1,100	ETHER SOLUBLES : 2

COD	PH	HARDNESS AS $CaCO_3$	TANNINS & LIGNINS	SODIUM AS NA	POTASSIUM AS K	CONDUCTIVITY IN MICROMHOS PER CC	CHLORIDE AS CL	IRON AS FE	COPPER AS CU	ZINC AS ZN	CHROMIUM AS CR	MANGANESE AS MN
<30	7.3	222	0.5	19	1.3	481	33	0.20	0.0	0.0	0.0	0.06

TABLE 5 - (CONT'D)

STREAM C

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM)			OXYGEN SATURATION			NITROGEN AS N (PPM)				PHOSPHORUS AS P		BACTERIOLOGICAL RESULTS		ADDITIONAL ANALYSIS
				TOTAL	SUSP.	DISS.	TEMP. (^{0}C)	DISS. OXYGEN (PPM)	% SATURATION	FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	TOTAL	SOLUBLE	TOTAL COLIFORMS	FECAL COLIFORMS	
SC-0.87	STREAM C - WEST SIDE OF DUNLOP STREET	28/7/71	0.4	330	5	325										80 +	80 +	ETHER SOLUBLES : <1
SCTE-0.97	TRIBUTARY E OF STREAM C EAST OF HWY. 400	12/5/71	0.8	340	20	320				.02	.35	.006	.45	.030	.009	116 •	56	
		10/6/71	0.6	320	10	310	13.5	9.5		.02	.28	.003	.40	.032	.006	30	20	
		30/6/71	0.2	-	10	-	15.5	8.6		.01	.31	.003	.36	.027	.002	300	300	
SC-0.97	STREAM C EAST OF HENRY STREET NEAR HWY. 400	12/5/71	1.0	290	10	280				.01	.18	.015	.10	.026	.005	2,200	600	
		30/6/71	0.4	-	5	-				.03	.34	.018	.94	.034	.012	2,600	700	TURBIDITY : 8
SCTC-1.22	TRIBUTARY C OF STREAM C EAST OF EDGEHILL DRIVE	12/5/71	1.0	240	5	235				.01	.29	.013	1.7	.024	.005	900	400	
		10/6/71	0.8	250	5	245	21	8.7		.04	.26	.011	1.3	.027	.022	16	4	
		30/6/71	0.8	-	10	-	25	8.0		.03	.53	.026	1.1	.055	.008	3,000	700	TURBIDITY : 6
SCTD-1.22	TRIBUTARY D OF STREAM C EAST OF EDGEHILL DRIVE	12/5/71	0.6	280	10	270				.01	.18	.006	.55	.022	.010	114	50	

TABLE 5 - (CONT'D)

STREAM C

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SUSP.	DISS.	OXYGEN SATURATION TEMP. (°C)	DISS. OXYGEN (PPM)	% SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	PHOSPHORUS AS P TOTAL	SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	FECAL COLIFORMS	ADDITIONAL ANALYSIS
SCTA-0.95	TRIBUTARY A OF STREAM C	2/11/65	1.7	260	1	259										220		
	JUST ABOVE PLAZA	17/8/66	0.7	286	1	285										500		
		30/6/71	0.4	-	10	-	17	8.8		.01	.46	.004	1.3	.030	<.001	240	200	
SC-0.28	STREAM C - WEST OF	1/11/65	2.0	374	5	369										200		
	INNISFIL STREET	17/8/66	0.5	316	5	311										520		
		14/5/71	6.5	440	10	430	11		24.5	1.2	2.0	.024	1.0	.040	.001	2,800	600	
		2/7/71	3.5	-	15	-	18	7.2		1.1	1.2	.048	.62	.040	<.002	2,700	300	TURBIDITY : 15
		28/7/71	1.2													200	74	

DATE SAMPLED	COD	PH	HARDNESS AS $CaCO_3$	TANNINS & LIGNINS	SODIUM AS NA	POTASSIUM AS K	CONDUCTIVITY IN MICROMHOS PER CC	CHLORIDE AS CL	IRON AS FE	COPPER AS CU	ZINC AS ZN	CHROMIUM AS CR	MANGANESE AS MN
28/7/71	<30	7.8	254	0.5	33	1.6	632	66	1.2	.02	0.10	0.0	0.09

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SUSP.	DISS.	TEMP. (°C)	DISS. OXYGEN (PPM)	% SATURATION	FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	PHOSPHORUS TOTAL	SOLUBLE	TOTAL COLIFORMS	FECAL COLIFORMS	ADDITIONAL ANALYSIS
SCTB-0.57	TRIBUTARY B OF STREAM	1/11/65	2.8	236	20	216										1,800		
	C NORTH OF PERRY STREET	14/5/71	2.0	620	5	615				.04	.25	.006	2.5	.011	.001	110	62	
	AND EAST OF BOYS STREET	2/7/71	0.6	-	15	-	15	10.3		.03	.38	.005	1.2	.048	.004	1,000	200	
SCTB-0.57 W	18-INCH DIAMETER CONCRETE	1/11/65	FLOW INSUFFICIENT FOR SAMPLING															
	STORM OUTLET IMMEDIATELY	17/8/66														230		
	NORTH OF PERRY STREET	14/5/71	1.6	560	5	555	8		24.5	.01	.15	.001	2.8	.004	<.001	0	0	
	DRAINING EAST TO STREAM																	

CITY OF BARRIE

OUTFALL TABULATION AND ANALYTICAL RESULTS

STREAM D

APPENDIX H

TABLE 6

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	SOLIDS (PPM) DISS.	OXYGEN SATURATION TEMP. (^{0}C)	OXYGEN SATURATION DISS. OXYGEN (PPM)	OXYGEN SATURATION % SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITROGEN AS N (PPM) NITRITE	NITROGEN AS N (PPM) NITRATE	PHOSPHORUS AS P TOTAL	PHOSPHORUS AS P SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	BACTERIOLOGICAL RESULTS FECAL COLIFORMS	ADDITIONAL ANALYSIS
SD-0.00	STREAM D AT 48-INCH	2/11/65	1.4	420	2	418	40	13								3,400		
	DIAMETER OUTLET TO	16/8/66	12.0	472	123	349	15	8								91C,000		
	KEMPENFELDT BAY	19/5/71	1.2	370	1C	360				.02	.34	.010	2.4	.036	.003			IRON AS FE: 0.40 PHENOLS : 10 PPB
		8/6/71	3.5	420	5	415	11	8.5		.01	.14	.016	2.9	.030	.008	1,400	1,300	PHENOLS : 4 PPB
		2/7/71	0.4	-	5	-	14	8.2		.06	.14	.014	2.8	.024	.008	1,600	100	TURBIDITY : 6
SD-0.03	26-INCH CONCRETE STORM	2/11/65	PARTIALLY SUBMERGED FLOW NOTED															
W	SEWER EAST OF CN TRACKS	17/8/66	PARTIALLY SUBMERGED FLOW NOTED															
SD-0.09	STREAM D - BOTTOM OF	19/5/71	NO FLOW															
	TORONTO STREET	27/7/71	0.2	440	10	430	12	9.8								500	400	
SD-0.38	STREAM D - WEST OF	2/11/65	1.9	324	2	322										3,800		
	DUNLOP STREET	17/8/66	1.0	416	4	412										34,000		

SD-0.09 (27/7/71):

COD	PH	CHROMIUM AS CR	ETHER SOLUBLES
<30	7.8	0.0	<1

TABLE 6 - (CONT'D)

STREAM D

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SUSP.	DISS.	OXYGEN SATURATION TEMP. (°C)	DISS. OXYGEN (PPM)	% SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	PHOSPHORUS AS P TOTAL	SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	FECAL COLIFORMS	ADDITIONAL ANALYSIS
SD-0.38	STREAM D - WEST OF	19/5/71	0.6	350	10	340				<.01	.28	.008	2.5	.028	.003	1,300	290	
	DUNLOP STREET	2/7/71	0.6	-	5	-	15.5	9.8		.04	.21	.011	2.8	.020	.004	1,900	100	TURBIDITY : 6
		27/7/71	0.2	390	5	385	11.0	10.1								1,000	200	

	DATE	COD	PH	CHROMIUM AS CR	ETHER SOLUBLES
	27/7/71	7	7.9	0.0	<2

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS TOTAL	SUSP.	DISS.	TOTAL COLIFORMS
SD-0.38 P	8-INCH DIAMETER CLAY OUTLET - WEST OF DUNLOP STREET		NO FLOW				
SD-0.38 W	16-INCH DIAMETER CONCRETE	2/11/65	NO FLOW				
	STORM SEWER - WEST OF	17/8/66	1.6	480	1	479	20
	DUNLOP STREET	19/5/71	NO FLOW				
SD-0.38 P-2	6-INCH DIAMETER CLAY OUTLET WEST OF DUNLOP STREET		NO FLOW NOTED				
SD-0.38 P-3	2-INCH DIAMETER IRON OUTLET WEST OF DUNLOP STREET		NO FLOW NOTED				

TABLE 6 - (CONT'D)

STREAM D

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM)			OXYGEN SATURATION			NITROGEN AS N (PPM)				PHOSPHORUS AS P		BACTERIOLOGICAL RESULTS		ADDITIONAL ANALYSIS
				TOTAL	SUSP.	DISS.	TEMP. (°C)	DISS. OXYGEN (PPM)	% SATURATION	FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	TOTAL	SOLUBLE	TOTAL COLIFORMS	FECAL COLIFORMS	
SD-0.56 W	12-INCH DIAMETER CONCRETE STORM SEWER - DONALD STREET WEST OF ECCLES STREET		NO FLOW NOTED															
SD-0.56	STREAM D NORTH OF DONALD STREET	2/11/65	0.5	130	1	129										3,900		
		17/8/66	0.6	396	4	392										1,280		
		19/5/71	0.4	350	10	340				<.01	.32	.006	2.7	.028	.002	3,500	290	
		30/6/71	5.0	-	370	-	18	8.2		.07	1.2	.013	2.5	.092	.004	2,700	1,500	TURBIDITY : 12
SD-0.64 W	12-INCH DIAMETER CONCRETE STORM SEWER - ECCLES STREET AT SOPHIA STREET		UNDER ROAD INACCESSIBLE NO FLOW															
SD-0.64 W-2	12-INCH DIAMETER CONCRETE STORM SEWER - ECCLES STREET AT SOPHIA STREET		NO FLOW NOTED															
SD-0.76 W	12-INCH DIAMETER CLAY STORM SEWER - SOUTH-WEST CORNER OF ROSS STREET AND WELLINGTON STREET		NO FLOW NOTED															

TABLE 6 – (CONT'D)

STREAM D

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SUSP.	DISS.	TEMP. (°C)	OXYGEN SATURATION DISS. OXYGEN (PPM)	% SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	PHOSPHORUS AS P TOTAL	SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	FECAL COLIFORMS	ADDITIONAL ANALYSIS
SD-0.76 W-2	18-INCH DIAMETER CONCRETE STORM SEWER – NORTH-WEST OF CORNER OF ROSS AND WELLINGTON STREETS		NO FLOW NOTED															
SD-0.76 W-3	12-INCH DIAMETER CLAY STORM SEWER – NORTH-WEST CORNER OF ROSS AND WELLINGTON STREETS		NO FLOW NOTED															
SD-0.76	STREAM D – NORTH OF THE INTERSECTION OF WELLINGTON AND ROSS STREETS	2/11/65	0.9	352	2	350										116		
		17/8/66	0.6	348	4	344										960		
		19/5/71	0.4	350	10	340				.01	.24	.006	2.7	.016	.006	1,700	170	
		30/6/71	0.4	-	10	-	15	8.7		.03	.42	.008	3.0	.028	.002	1,300	700	
SDTA-0.76	TRIBUTARY A OF STREAM D – WEST SIDE OF WELLINGTON STREET	30/6/71	0.4	-	5	-	14	8.9		.02	.36	.007	3.0	.028	.012	1,600	1,000	
SD-1.45	STREAM D – EAST OF SUNNIDALE ROAD ABOVE CITY	18/5/71	0.6	320	10	310				.03	.27	.006	3.9	.012	.010	52	8	
		2/7/71	0.4	-	5	-	13	9.8		.01	.30	.006	3.7	.028	<.002	200	66	

CITY OF BARRIE

OUTFALL TABULATION AND ANALYTICAL RESULTS

STREAM E

APPENDIX H

TABLE 7

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	SOLIDS (PPM) DISS.	OXYGEN SATURATION TEMP. (°C)	OXYGEN SATURATION DISS. OXYGEN (PPM)	OXYGEN SATURATION % SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITROGEN AS N (PPM) NITRITE	NITROGEN AS N (PPM) NITRATE	PHOSPHORUS AS P TOTAL	PHOSPHORUS AS P SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	BACTERIOLOGICAL RESULTS FECAL COLIFORMS	ADDITIONAL ANALYSIS
SE-0.00	STREAM E AT OUTLET TO KEMPENFELDT BAY - RECEIVING WATER	2/11/65	PARTIALLY SUBMERGED															
		16/8/66	3.2	302	5	297	17.5	4.5								143,000		
		8/6/71	5.0	480	5	475	12.5	7.5		.22	.85	.042	.74	.17	.032	8,000 +	3,200	PHENOLS : 20 PPB
		27/7/71	1.6	1,330	5	1,325	15.0	4.7								14,000	600	
SE-0.28 W	12-INCH DIAMETER CLAY STORM SEWER - PARK STREET WEST OF TORONTO STREET		UNDER ROAD INACCESSIBLE															
SE-0.28	STREAM E JUST NORTH OF PARK STREET	5/11/65	8.0	526	13	588										110,000		
SE-0.42	STREAM E JUST WEST OF TORONTO STREET AT CULVERT DISCHARGE	5/11/65	8.0	526	13	588										1,070,000		
		17/8/66	49.0	608	20	388										3,000		VARIABLE FLOW

SE-0.00 (continued):

DATE SAMPLED	CALCIUM AS CA	MAGNESIUM AS MG	CHLORIDE AS CL	SODIUM AS NA	POTASSIUM AS K	IRON AS FE	TURBIDITY UNITS	PH
27/7/71	81	34	511	228	44	0.60	20	7.7

TABLE 7 - (CONT'D)

STREAM E

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SUSP.	DISS.	OXYGEN SATURATION TEMP. (°C)	DISS. OXYGEN (PPM)	% SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	PHOSPHORUS AS P TOTAL	SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	FECAL COLIFORMS	ADDITIONAL ANALYSIS
SE-0.42 W	16-INCH DIAMETER CONCRETE STORM SEWER DISCHARGING INSIDE THE LARGE CULVERT ALONG ROSS STREET WEST	17/8/66	F L O W	O B S E R V E D														
SE-0.42 W-2	16-INCH DIAMETER CONCRETE STORM SEWER DISCHARGING INSIDE THE LARGE CULVERT ALONG ROSS STREET WEST AT TORONTO STREET	17/8/66	F L O W	O B S E R V E D														
SE-0.66 P	6-INCH DIAMETER CLAY OUTLET VIA BAYFIELD STREET NORTH OF WELLINGTON STREET WEST	5/11/65 17/8/66	DISCHARGE TO MANHOLE OBSERVED C O R R E C T E D															
SE-0.93 W	STORM SEWER ON PEEL STREET NORTH OF SOPHIA STREET EAST		UNDER ROAD TO CULVER INACCESSIBLE															

TABLE 7 (CONT'D)

STREAM E

SAMPLING POING	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SUSP.	DISS.	OXYGEN SATURATION TEMP. (^{0}C)	DISS. OXYGEN (PPM)	% SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	PHOSPHORUS AS P TOTAL	SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	FECAL COLIFORMS	ADDITIONAL ANALYSIS
SE-0.95	STREAM E JUST EAST OF	5/11/65	2.6	1,400	23	1,377										790		
	INTERSECTION OF PEEL	17/8/66	NO FLOW NOTED															
	AND SOPHIA STREETS	19/5/71	16.0	2,030	15	2,015				<.01	.70	.030	.67	.31	.23	1,500	580	IRON AS FE : 0.70
SE-0.95 W	18-INCH DIAMETER CONCRETE STORM SEWER JUST WEST OF MULCASTER STREET (UNIMPROVED)		NO FLOW NOTED															
SE-0.95 W-2	10-INCH DIAMETER GALVANIZED IRON STORM SEWER ON MULCASTER STREET (UNIMPROVED)		NO FLOW NOTED															
SE-1.04	STREAM E JUST WEST OF	5/11/65	1.7	438	9	429										850		
	BERCZY STREET	17/8/66	FLOW INSUFFICIENT FOR SAMPLING															
		19/5/71	7.0	730	15	715				.01	.74	.031	1.5	.16	.072	21,600	30	
		2/7/71	*	-	300	-	16.5	7.6		*	3.0	*	*	.30	*	16	8	
		27/7/71	0.4	450	5	445	13.0	10.1								3,000	100	

DATE	CONDUCTIVITY IN MICROMHOS PER CM^3	PH AT LAB	CHLORIDE AS CL	HARDNESS AS $CACO_3$	SODIUM AS NA	PHENOLS IN PPB	CALCIUM AS CA	POTASSIUM AS K	IRON AS FE	TURBIDITY	MAGNESIUM AS MG
2/7/71	100,000	7.2	52,000	9,000	29,000	4					
27/7/71		8.2	94		75		52	1.9	4.7	30	18

* INTERFERENCE IN ANALYSIS DUE TO VERY HIGH VOLATILE ORGANIC SOLIDS

TABLE 7 - (CONT'D)

STREAM E

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	SOLIDS (PPM) DISS.	OXYGEN SATURATION TEMP. (°C)	OXYGEN SATURATION DISS. OXYGEN (PPM)	OXYGEN SATURATION % SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITROGEN AS N (PPM) NITRITE	NITROGEN AS N (PPM) NITRATE	PHOSPHORUS AS P TOTAL	PHOSPHORUS AS P SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	BACTERIOLOGICAL RESULTS FECAL COLIFORMS	ADDITIONAL ANALYSIS
SE-1.04 W	24-INCH DIAMETER CONCRETE STORM SEWER SOUTH-WEST OF INTERSECTION OF BERCZY AND QUEEN STREETS - CONTAINS DISCHARGE FROM CULLIGAN WATER CONDITIONERS	17/8/66	UNDER ROAD	INACCESSIBLE														
SE-1.04 W-2	STORM SEWER DISCHARGING TO CULVERT AT QUEEN STREET JUST EAST OF BERCZY STREET		INACCESSIBLE	NO APPARENT FLOW														
SE-1.11 W	STORM SEWER DISCHARGING TO CULVERT AT WELLINGTON STREET EAST JUST EAST OF BERCZY STREET		INACCESSIBLE	NO APPARENT FLOW														
SE-1.23 W	24-INCH DIAMETER CONCRETE STORM SEWER ON GUNN STREET JUST OFF DAVIDSON STREET		NO FLOW NOTED															
SE-1.23 W-2	STORM SEWER JUST SOUTH OF INTERSECTIONS OF GUNN AND DAVIDSON STREET		NO FLOW NOTED															

TABLE 7 - (CONT'D)

STREAM E

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	SOLIDS (PPM) DISS.	OXYGEN SATURATION TEMP. (°C)	OXYGEN SATURATION DISS. OXYGEN (PPM)	OXYGEN SATURATION % SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITROGEN AS N (PPM) NITRITE	NITROGEN AS N (PPM) NITRATE	PHOSPHORUS AS P TOTAL	PHOSPHORUS AS P SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	BACTERIOLOGICAL RESULTS FECAL COLIFORMS	ADDITIONAL ANALYSIS
SE-1.47 W	STORM SEWER JUST WEST OF INTERSECTION OF GROVE STREET EAST AND BOTHWELL CRESCENT	UNDER ROAD INACCESSIBLE NO APPARENT FLOW																
SE-1.47 W-2	18-INCH DIAMETER CONCRETE STORM SEWER ON BOTHWELL CRESCENT JUST NORTH OF GROVE STREET EAST	NO FLOW NOTED																
SE-1.80	STREAM E - SOUTH OF ST. VINCENT STREET AND WEST OF GROVE STREET	19/5/71	2.5	350	50	300				.02	.74	.028	.65	.088	.003	15,000 +	10	IRON AS FE : 1.2
SE-1.80 W		NO FLOW NOTED																

CITY OF BARRIE

OUTFALL TABULATION AND ANALYTICAL RESULTS

STREAM B

EFFECT OF SANITARY LANDFILL SITE

APPENDIX H

TABLE 8

SAMPLING POINT	LOCATION AND DESCRIPTION	DATE SAMPLED	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	SOLIDS (PPM) DISS.	OXYGEN SATURATION TEMP. ($^{\circ}C$)	OXYGEN SATURATION DISS. OXYGEN (PPM)	OXYGEN SATURATION % SATURATION	NITROGEN AS N (PPM) FREE AMMONIA	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITROGEN AS N (PPM) NITRITE	NITROGEN AS N (PPM) NITRATE	PHOSPHORUS AS P TOTAL	PHOSPHORUS AS P SOLUBLE	BACTERIOLOGICAL RESULTS TOTAL COLIFORMS	BACTERIOLOGICAL RESULTS FECAL COLIFORMS	ADDITIONAL ANALYSIS
SB-3.29	STREAM B APPROX. 25 YD. FROM APPARENT SPRING SOURCE JUST SOUTH-EAST OF ENTRANCE TO LANDFILL SITE	28/7/71	550		120													
SB-3.00	STREAM B JUST UPSTREAM OF JUNCTION WITH TRIBUTARY A	18/5/71	200	610	40	570				2.8	3.9	.015	.76	.050	.001	60	10	
SB-2.67	STREAM B - WEST SIDE OF EDGEHILL DRIVE APPROX. ½ MILE DOWNSTREAM OF LANDFILL SITE	13/5/71	130	560	20	540	10		25	1.7	2.8	.015	.78	.045	.001	52	38	
		18/5/71	120	185	25	460				2.0	2.8	.014	.78	.050	.001	80	30	
		10/6/71	130	520	30	490	14	8.8		1.9	3.2	.011	.47	.060	.001	90	24	
		28/7/71	130	-	20	-										300	200	
SB-2.11	STREAM B - WEST SIDE OF DUNLOP STREET APPROX. 1 MILE DOWNSTREAM OF LANDFILL SITE	11/5/71	24	520	15	505				1.4	2.2	.007	<.1	.036	.008	90	30	
		13/5/71	44	480	15	465	13.5		10	1.4	2.2	.016	.05	.020	.003	70	32	
		10/6/71					10	5.0		1.1	4.1	.003	<.01	.20	<.001	400	120	

CITY OF BARRIE

OUTFALL TABULATION AND ANALYTICAL RESULTS

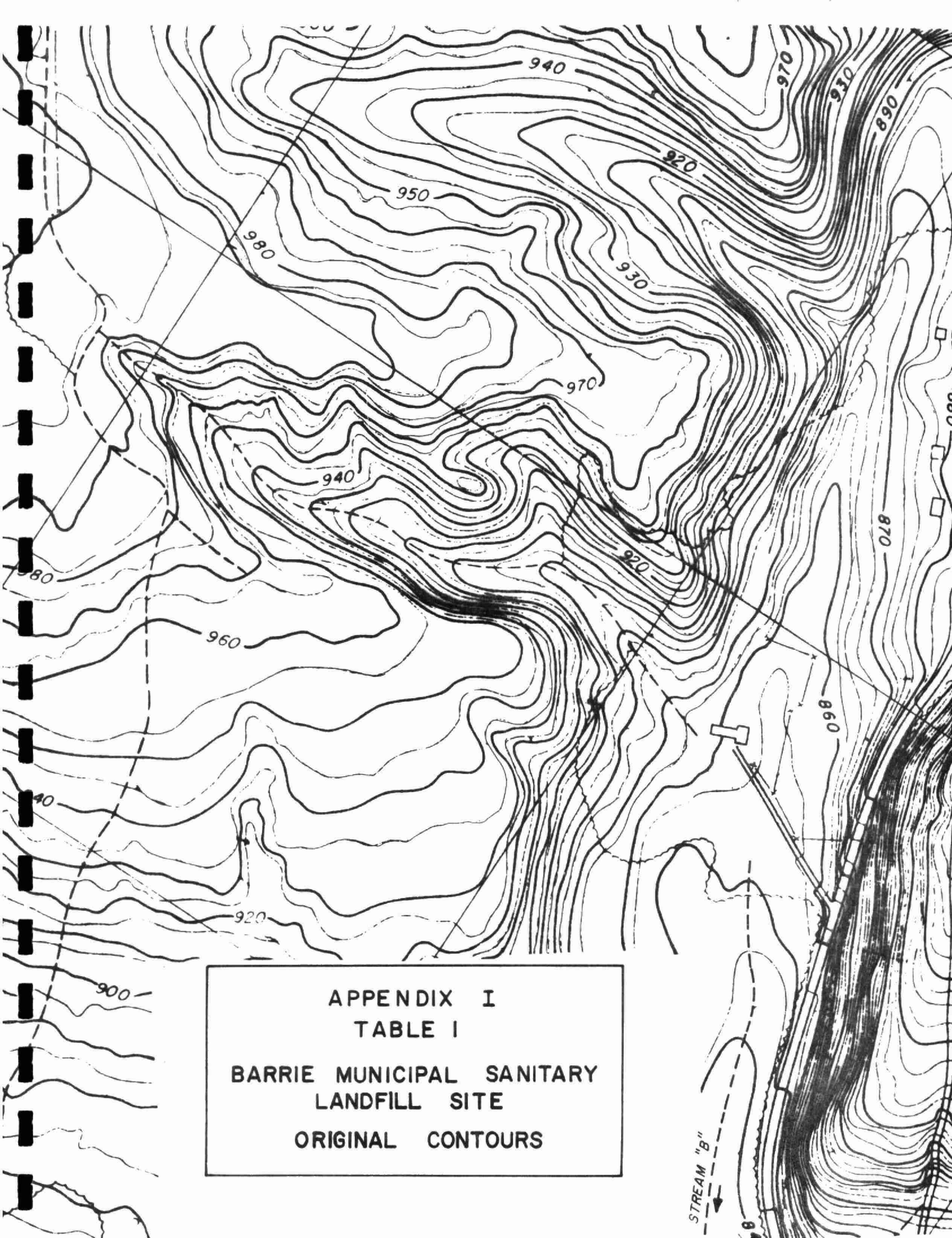
STREAM B

EFFECT OF SANITARY LANDFILL SITE

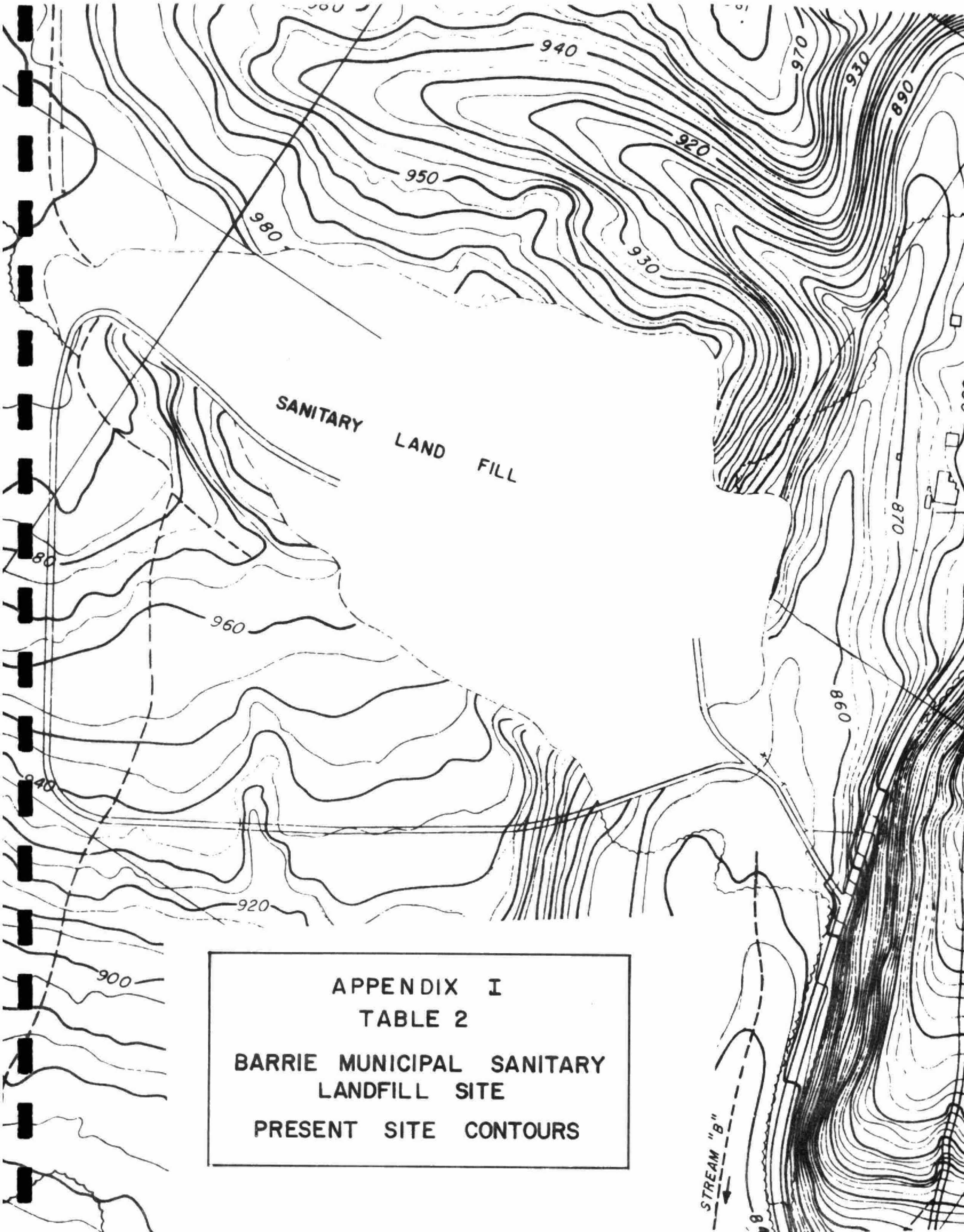
APPENDIX H

TABLE 9

SAMPLING POINT	DATE SAMPLED	COD	HARDNESS AS $CaCO_3$	ALKALINITY	TANNINS & LIGNINS	SODIUM AS NA	POTASSIUM AS K	SULPHATE AS SO_4	CONDUCTIVITY IN MICROMHOS PER CM^3	CHLORIDE AS Cl^2	IRON AS FE	COPPER AS CU	MANGANESE AS MN	CHROMIUM AS CR	CALCIUM AS CA	ZINC AS ZN	PH
SB-3.29	28/7/71	735	652		2.0	70	16.4		1458	130	4.3	0.0	2.12	0.0		0.0	6.9
SB-2.67	10/6/71	170	340	288	3.5	21	3.4	11	680	104	12.0		0.23		116		8.0
							MAGNESIUM AS MG : 12		PHENOLS IN PPB : 60			ACIDITY AS $CaCO_3$: 11					
	28/7/71	170	350		0.5	22	3.5		714	46	1.9	0.0	0.63	0.0		0.0	7.6
SB-2.11	10/6/71	105	328	CARBON: TOT. ORG. 36.5	CARBON: INORG. 64.0	20		11	678	28	2.4						8.0



APPENDIX I
TABLE I
BARRIE MUNICIPAL SANITARY LANDFILL SITE
ORIGINAL CONTOURS



APPENDIX I

TABLE 2

BARRIE MUNICIPAL SANITARY LANDFILL SITE

PRESENT SITE CONTOURS

CITY OF BARRIE

PROJECTED SANITARY WORKS PROGRAM 1971 - 1975

APPENDIX J

DESCRIPTION	YEAR TO BE COMPLETED
Public Works	
Storm Sewers & Watercourses	
Storm Sewers	
Sophia Street enlargement of culvert	1971
Anne Street from Hwy. 400 to Letitia Street	1971
William Street from Gowan Street to Cumberland Street	1971
Nelson Street from Grove Street East to Colleen Avenue	1971
Bradford Street extension to storm sewer culvert at Orv Hardy Motors	1971
William Street from Cumberland Street to Baldwin Lane	1972
Provision for Storm Sewers Purchase & Improvement of Watercourses	1971 - 1975
Sanitary & Waste Removal	
New primary clarifier and raw sewage pumping station at the Water Pollution Control Plant	1971
Aeration and sludge thickener equipment	1971
New 24" diameter Forcemain from Toronto Street Pumping Station to the Water Pollution Control Plant	1972

APPENDIX J - (Cont'd)

DESCRIPTION	YEAR TO BE COMPLETED
Sanitary & Waste Removal	
New 2.5 MGD pumping unit at the Water Pollution Control Plant main pumping station	1974
New Final Settling Tank beside existing final settling tanks to increase capacity 50%	1975
Sanitary Land Fill - purchase of land	1973
Trunk Sanitary Sewers	
Trunk sewer from Vespra Street to Hwy. 400 at Dunlop Street West	1971
Trunk sewer from Hwy. 400 at Dunlop Street West to Anne Street North at Edgehill Drive	1971
Along Brock Street & Patterson Road from Lorena Street to Universal Coolers	1972
Along Ellen Street from Brock Street to John Street	1973
Along Allandale Avenue from CNR to South Limit of the City	1974
Barrie Golf Club - Property servicing incl. extension of Sunnidale Road sewer from Parker Drive to Cundles Road	1971 - 1973
Local Improvements	
Sanitary Sewers	
Edgehill Drive from Anne Street to Ferndale Drive	1972
Anne Street from Edgehill to Letitia Street	1971
Blake Street extension including pumping station	1973
Industrial Road between St. Vincent Street and Duckworth Street	1971

APPENDIX J - (Cont'd)

DESCRIPTION	YEAR TO BE COMPLETED
Local Improvements	
Water Mains	
Industrial Road between St. Vincent Street and Duckworth Street	1971
Utilities	
Waterworks	
Drilling deep artesian well on Hydro property off Tiffin Street and installing pumping station; installation of inline booster pumping stations on Bayview Drive & Adelaide Street; installation of 12" connecting feeder mains from Tiffin Street; installation of 8" feeder main on Anne Street south & Adelaide Street - 925'; installation of 8" feeder main on Tiffin Street from Dyment Road to Patterson Road - 600'; installation of 8" feeder main on Adelaide Street in the Stephenson subdivision - 725'	1971
Purchase & initial rehabilitation of the Wonder Valley (Ontario Govt.) well site; drilling deep artesian well site at the site of existing Anne Street well; installing inline booster pumping station on Patterson Road & 8" feeder main on Ardagh Road east under Hwy. 400 to Little Avenue - 1,700'	1972
Purchase & installation of booster pumping station at the Wonder Valley well site & installation of 5,300' of 12" feeder main from the well south along Blake Street to Grove Street; installing 12" feeder main on Cundles Road west from Bayfield Street to Sunnidale Road - 4,000'	1973

APPENDIX J - (Cont'd)

DESCRIPTION	YEAR TO BE COMPLETED
Utilities	
Waterworks	
Exploration for & drilling deep artesian well in Innisfil Township & installing pumping station & necessary 12" connecting feeder mains	1974
Purchase of land & construction of large reservoir (one million gallons) in south section of the city; drilling deep artesian well at the existing Mary Street well site	1975

APPENDIX K

BACTERIOLOGICAL EXAMINATION

The bacteriological report is, basically, a report on the presence or absence of coliform bacteria in the sample submitted.

The direct search for the presence of specific pathogenic bacteria or viruses in water is impracticable for routine control purposes. Bacteriologists have therefore evolved simple and rapid tests for the detection of normal intestinal organisms, i.e. coliform bacteria, faecal streptococci and Clostridium perfringens. The test provides an estimate of the number of coliform organisms present in 100 millilitres, which is equivalent to about 4 fluid ounces, of the water sampled.

The organisms most commonly used as indicators of faecal pollution are the coliform group as a whole, and particularly Escherichia coli, which is undoubtedly of faecal origin, and is referred to as faecal coliforms in the bacteriological report.

Examination for faecal streptococci and for clostridium may sometimes be of value in confirming the faecal nature of pollution in doubtful cases. Faecal streptococci regularly occur in faeces in varying numbers,

which are usually considerably smaller than those of E. coli. When organisms of the coliform group but not E. coli are found in a water sample, the finding of faecal streptococci affords important confirmatory evidence of the faecal nature of the pollution. Clostridium is also regularly found in faeces though generally in much smaller numbers than E. coli. The spores are capable of surviving in water for a longer time than organisms of the coliform group and usually resist chlorination at doses normally used in water works practice. The presence of clostridium in a natural water suggest that faecal contamination has occurred, and its presence in the absence of organisms of the coliform group suggests that the contamination occurred at some remote date.

Colony counts provide an estimate of general bacterial purity, which is of particular value when water is used industrially for the preparation of food and drink. They may also give forewarning of pollution.

Faecal coliforms usually outnumber all the other coliform types in the human and animal intestines by a ratio of more than 500 to 1. Outside the body, faecal coliforms die off more quickly than the other coliform types. Therefore, if most of the coliforms are faecal coliforms, and their number is high, the pollution is probably nearby,

recent, and relatively more dangerous. Smaller numbers but a high proportion of faecal coliforms may indicate nearby pollution with counts reduced by dilution.

APPENDIX L

ANALYTICAL TERMS

ANIONIC DETERGENTS (as Alkyl Benzene Sulphonate - A.B.S.)

The presence of detergents in natural waters usually indicates contamination by domestic wastes. While A.B.S. is not toxic to most biota at low levels, it can be objectionable because of the foaming it may cause.

Samples which do not produce any foam when shaken vigorously contain less than 0.5 mgms per l. This is the objective for natural waters, and it is not necessary to request A.B.S. analysis on samples if shaking does not induce a perceptible foam.

The results include both A.B.S. and the recently introduced "linear" forms L.A.S., although pure A.B.S. is used to calibrate the test and the results are expressed in these terms.

BIOCHEMICAL OXYGEN DEMAND (BOD)

The most frequent damage caused by the discharge of wastes to natural waters, next only to bacterial contamination, is the reduction of dissolved oxygen concentrations to levels which cannot support normal aquatic life. The resulting fish kills are accompanied by deterioration of the water quality for all uses. The dissolved oxygen is depleted through oxidation

of the organic content of the wastes by bacteria (occasionally by direct chemical oxidation). The BOD test is a measure of the amount of dissolved oxygen required for the process of stabilization of the decomposable organic matter by aerobic bacterial action in a specific length of time (five days) under standard conditions (20°C in the dark).

CHEMICAL OXYGEN DEMAND (COD)

The chemical oxygen demand determination measures the weight of oxygen which will react with a given waste material under vigorous chemical oxidation conditions. The test gives a rapid estimate of the strength of a waste and is particularly useful for industrial wastes on which the BOD test is not applicable as it may give false low results.

Most organic compounds are oxidized by the test, benzene, toluene and pyridine being the common exceptions. The silver catalyst aids in oxidizing straight chain compounds. The results do not necessarily relate directly to the BOD value or to the oxygen consumption in the receiving water. They do represent a maximum carbonaceous oxygen demand which might ultimately be exerted in the water through time. Variations in COD from time to time at a given sampling location, or for a given effluent, may be more important than the absolute value of individual measurements. If comparative analysis show that a stable ratio exists between COD and BOD in a particular case,

the COD results can then be used to predict the approximate BOD values.

NITROGEN AS N

Free Ammonia and Total Kjeldahl Nitrogen

Free ammonia is undesirable in surface water because it is toxic to fish; exerts a high oxygen demand when converted to nitrite and nitrate by bacteria; interferes with chlorination procedures at water treatment plants and is a source of nitrogen for plants which can help promote excessive growth. It is rarely found in concentrations high enough to be harmful to humans.

The total kjeldahl nitrogen measures the sum of the free ammonia and the "organic nitrogen" (amines, proteins, etc.). "Organic nitrogen" can thus be obtained as the difference between the free ammonia and the total kjeldahl nitrogen results. The total kjeldahl nitrogen value does not include nitrite or nitrate which may be present in the sample.

Ammonia is often an indication of contamination by raw or partly treated sewage; however, because of its rather short life in surface waters it may not reveal completely the extent of the pollution. Results must be interpreted with full allowance for the perishability of this form of nitrogen, both in situ and in the sample

following collection.

Ammonia is often converted to organic forms by bacteria, particularly if there is a good supply of organic carbon, so the total kjeldahl nitrogen value can be a better indication of the effects of an ammonia input than the ammonia concentration alone.

There may be oxidation of ammonia to nitrite and nitrate, so that measurement of these two compounds, in addition to the total kjeldahl nitrogen, may be required to trace the effect of a waste input.

pH

pH is a measure of the hydrogen ion concentration in water. Specifically, it is the negative logarithm of the free hydrogen ion concentration expressed in moles per liter. Thus, each change of one unit in pH corresponds to a 10-fold hydrogen ion concentration change. Neutral solutions have a hydrogen ion concentration of 10^{-7} moles per liter; therefore, the pH is 7.

pH does not measure the total amount of acidity (or alkalinity) in the water, since some may be in a combined form and therefore will not be included in the pH measurement of free hydrogen ions. The combined forms can still be released to react with bases. The commonest example in water is the bicarbonate ion, which can react with acids to form carbonic acid,

or with bases to form carbonates and water.

PHOSPHORUS AS P

Soluble Phosphorus

The soluble phhsphorus content of a sample is that fraction which will pass through a filter and will react chemically with the reagents used to determine the concentration of orthophosphate yielding a positive test response.

It is generally accepted that some organic and even particulate forms can react similarly to orthophosphate and, for this reason, the results are often referred to as "soluble reactive phosphorus", which removes the implication that the test measures only orthophosphate.

The meaning of this parameter has been left in some doubt by a number of researchers (Rigler and Fitzgerald). They have shown that:

a) particulate matter which can pass through pore sizes of 0.22 microns can alter the result. (This laboratory has been unable to confirm this finding for Great Lakes samples);

b) the soluble phosphorus concentration can change rapidly with time after collection, unless adequately preserved.

Anyone making conclusions based on soluble phosphorus results should be acquainted with the various interpretations made of such results.

Total Phosphorus

Phosphorus is an essential plant nutrient and is believed to play an important role in the deterioration of the quality of natural waterways by promoting an overabundance of plants. It occurs in natural and waste waters in several different chemical combinations, such as orthophosphate (PO_4), organic phosphates and polyphosphates. Since most or all of these forms can eventually be used by plants and animals, determination of the total phosphorus concentration is more relevant than measurement of individual phosphorus compounds.

SOLIDS

Measurement of total, suspended and dissolved solids concentrations are traditional tests. An estimate of the organic fraction of the solids and of the organic content of sediments is obtained by heating the samples to 600°C in a furnace to burn off the combustible matter.

The suspended solids concentration relates to turbidity, and the dissolved solids concentration affects the specific conductivity, although there are no common factors for converting one to the other in all cases. A numerical

relationship can often be obtained for a given area or type of water. Ontario rivers, free of industrial wastes, have a dissolved solids concentration of 0.65 ± 0.10 times the specific conductivity. The dissolved solids by weight concentration test has been largely superseded by the more accurate conductivity measurement.

TURBIDITY

Clarity is one of the main criteria which the public uses in judging water quality, either for drinking or for recreational use. This makes the measurement of turbidity a much more valuable gauge of water quality than the suspended solids test, which measures only the weight of particles present in suspension and has little direct bearing on the appearance of the water. For instance, the presence of a few grains of sand or other coarse sediment, which produces a substantial suspended solids value, has little or no effect on the turbidity. It is recommended that field staff should make greater use of turbidity measurements <u>in place</u> of suspended solids tests.

OWRC Drinking Water Objectives have recently been decreased from 5 J.T.U. to 1 J.T.U., in recognition of the increased efficiency of water treatment now possible. (Note the limits of precision above).

Turbidity in large volumes of water is noticeable

at levels above 5 J.T.U., and many members of the public complain that the water is 'dirty' or 'cloudy' in such uses, particularly if they desire to swim or fish. Turbidity is certainly the main criterion which citizens employ in assessing the quality of water, and surveys of water quality should always include turbidity measurements.

Date Due

FEB 1 6 1972			